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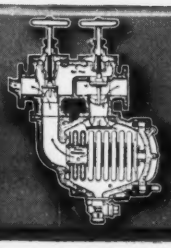

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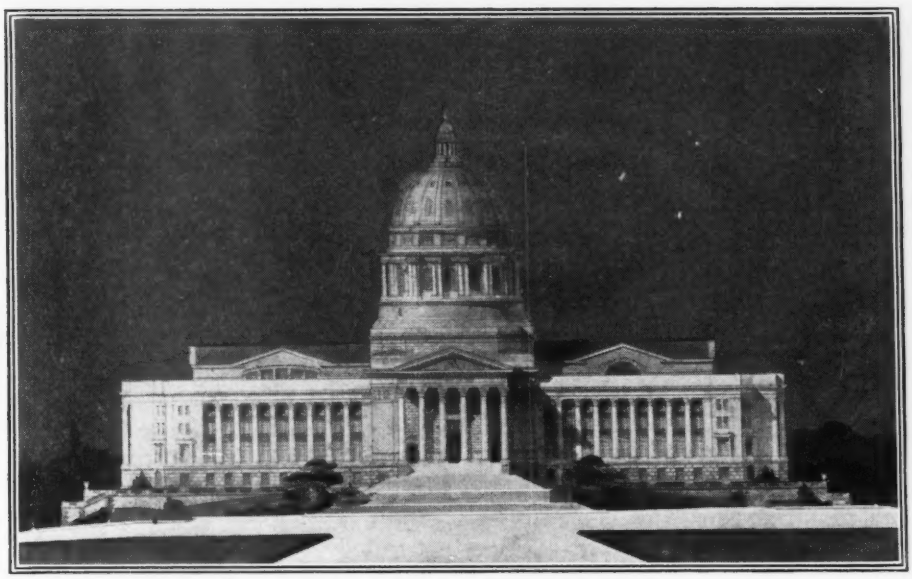


THE NEW STATE CAPITOL, JEFFERSON CITY, MO.

Heating and Ventilating Plant for the Missouri State Capitol

REVERSIBLE SYSTEM OF AIR SUPPLY FOR HOUSE AND SENATE CHAMBERS.

One of the largest building operations undertaken in some time is that of the new Capitol Building for the State of Missouri which is being erected at Jefferson City, Mo. Work is at present proceeding in a gratifying manner, but owing to the magnitude of the undertaking the exact date of occupancy is not as yet definitely determined. Our readers will probably be able to better grasp the meaning of this project when it is understood that the structure is costing close to $3,000,000.

This magnificent piece of architecture is being erected from plans and specifications prepared by Tracy & Swartwout, architects, of New York, and the mechanical equipment is being installed under the supervision of the Richard D. Kimball Co., engineers, New York. The general contract is rapidly being pushed to conclusion by the John Gill & Sons Co., general contractors, and the equipment is being installed by the Hanley-Casey Co., Chicago, contractors for the mechanical equipment.

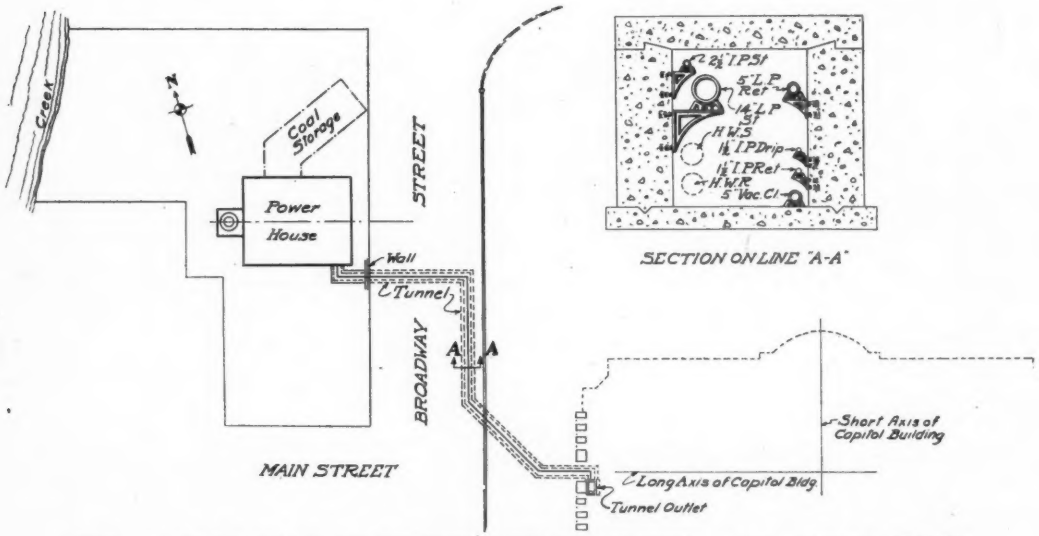


FIG. 1.—PLOT PLAN OF MISSOURI STATE CAPITOL AND POWER HOUSE AND PIPE TUNNEL.

ARRANGEMENT OF VARIOUS FLOORS.

The building is erected on concrete piers so as to bring it to a proper level with the grade of the surrounding streets and consists of a basement, ground floor and first, second and third floors. The basement is almost entirely given over to the uses of the mechanical equipment. All horizontal duct work, steam supply and return pipes, intermediate pressure lines, vacuum cleaning mains, together with the required fans, heaters, motors, air washers, kitchen, are placed on this level.

On the ground floor the natural resources museum occupies the center of one wing and a historical museum the center of the other wing. In the center of the building is a circular rotunda under the large dome and in the rear of this is located the dining room. Various state departments also find quarters on this floor.

The first floor, which is entered direct from the street by means of an imposing flight of steps, somewhat on the style of the United States Capitol at Washington, is occupied in the center by a continuation of the above-mentioned rotunda which gives entrance to corridors connecting with all other parts of the building. The two wings on this level are occupied by the upper parts of the two museums (which are of two-story height) and the rear is utilized for the Governor's reception room and executive offices. Other departments, together with the board of education "conference room," are placed on this floor.

The second floor gives entrance from its central rotunda to the floor of the House of Representatives on one side and to the floor of the Senate chamber on the other side. Connected to these are various lounge and committee rooms, while in the rear is the legislative library.

On the third floor the arrangement is quite similar to the second, the House and Senate galleries being located at this level and the upper part of the library. Various other small offices and some space not as yet assigned is included on this floor.

CAPITOL SERVED FROM SEPARATE PLANT.

The Capitol building is supplied with heat, light and power from a separate and distinct power house located approximately 250 ft. distant, the piping being carried underground in a tunnel which terminates in the basement of the Capitol building. A plot plan showing the relative location of the power house and the tunnel running to the Capitol building is given in Fig. 1, which also includes a detail cross section of the tunnel on Line A-A.

The power plant equipment consists of five Heine water tube boilers of 250

H. P. capacity, with space for the future installation of a sixth boiler.

The boilers are provided with damper regulators, 12-in. steam gauges, Reliance water columns and each has an 8-in. outlet for steam supply and a 5-in. outlet for safety valves. On each steam outlet an 8-in. automatic combination non-return and stop valve is placed with a pilot valve, and on the safety valve outlets are placed two 4-in. flanged pop safety valves set on a flanged safety valve yoke and arranged to blow at 130 lbs. The blow-off connections are 2½ in. These boilers are equipped with Murphy stokers. The stokers have a rated capacity of 250 H. P. each with a continuous operation overload capacity of 50% and a two-hour overload capacity of 75%.

An open type combined storage and feed water heater with a capacity for heating water for 1350 H. P., including 25% for overload and 50° F. initial temperature of water is provided. In connection with this is used a 3½-in. double-filtration multiple-cartridge feed-water filter of 1,250 H.P. capacity with a by-pass. The hot water tank for domestic hot water supply is installed in the power house to furnish hot water service to the Capitol building, this tank having steam coils and thermostatic regulation.

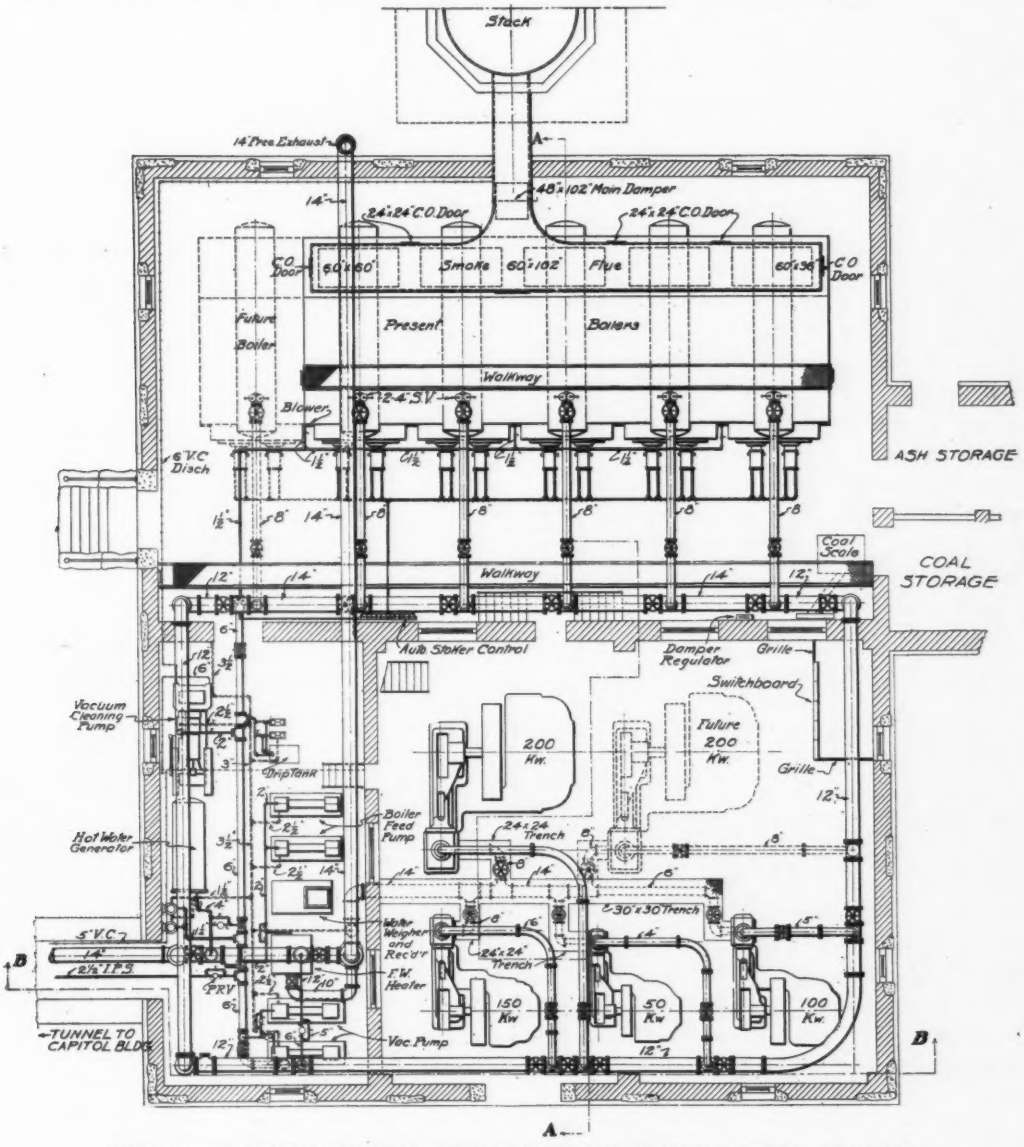


FIG. 2.—PLAN OF POWER HOUSE FOR MISSOURI STATE CAPITOL.

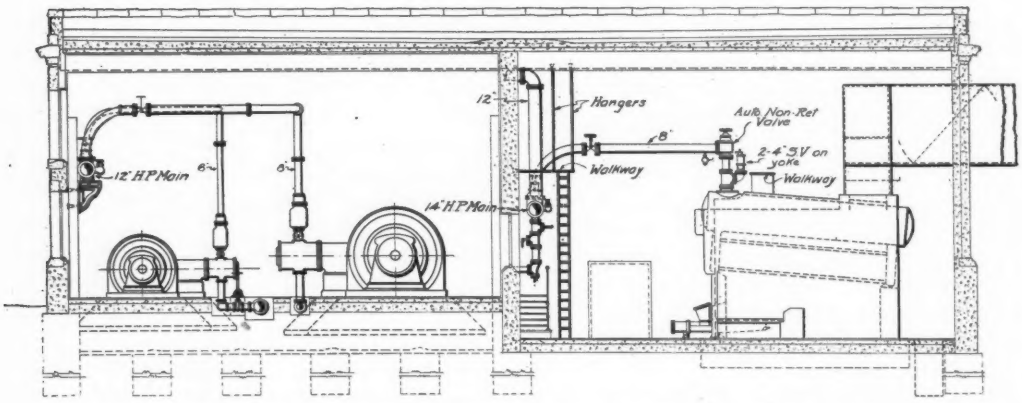


FIG. 3.—SECTION A-A, POWER HOUSE FOR MISSOURI STATE CAPITOL.

The boiler feed pumps consist of two 12-in.x8½-in.x12-in. pumps of Davidson make for a working pressure of 150 lbs. There are also installed two 14-in.x16-in.x16-in. vacuum pumps of Davidson make for pumping the heating returns to the air separating tank and feed water heater and maintaining a vacuum on the Capitol heating system. The blow-off tank is 36-in.x72-in. of cast iron with 4-in. drain connection and 4-in. vapor pipe run above the building roof. This tank has a cooling coil containing 20 sq. ft. of surface supplied with 1 in. cold water connection. The outboard exhaust is carried through the roof and is provided with a Swartwout muffler exhaust head of No. 16 galvanized iron with 1¼ in. drip.

Pressure reducing valves are installed in the power house as follows:

One 6 in. x 12 in. for the heating system reducing from 125 lbs. to 4 lbs.

One 2½ in. x 2½ in. for intermediate pressure steam from 125 lbs. to 40 lbs.

One 2½ in. x 2½ in. for the hot water tank from 125 lbs. to 4 lbs.

The back pressure valve which is located in the exhaust pipe in the pump room is a 14 in. multiple flanged noiseless back pressure and safety valve, adjustable from atmospheric to 8 lbs. of back pressure.

Anderson traps for various purposes are installed as follows:—

No. 1 for the return from hot water tank, 1½ in. size.

No. 2 for intermediate pressure drips, 1¼ in. size.

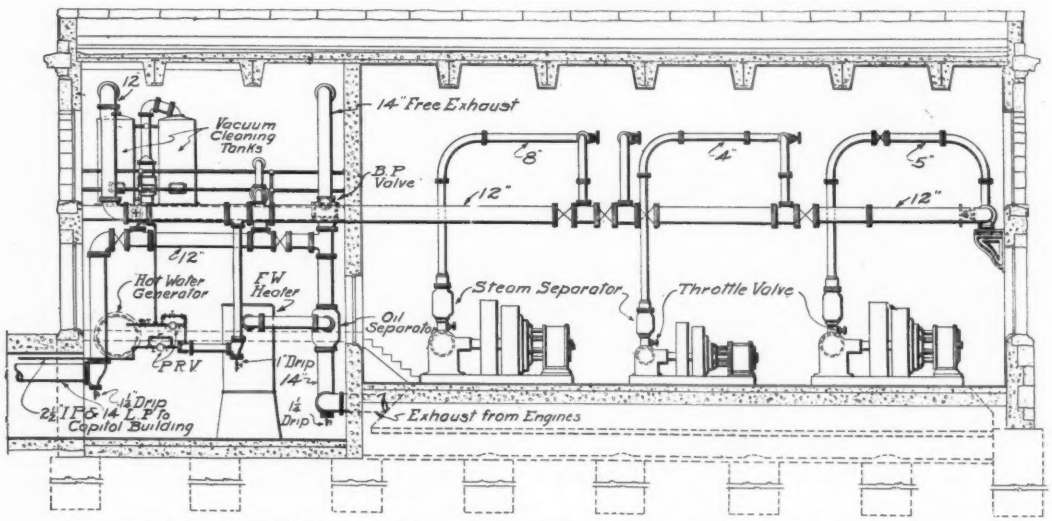


FIG. 4.—SECTION B-B, POWER HOUSE FOR MISSOURI STATE CAPITOL.

No. 3 for engine and separator drips, 2 in. size.

No. 4 for greasy drips, 2 in. size.

No. 5 for high pressure drips, 2 in. in size.

In Fig 2 a complete floor plan of the power house is given, showing the general arrangement and all the main piping, sectional elevation on Line "A-A" and Line "B-B" being indicated in Figs. 3 and 4.

THREE GENERAL DIVISIONS OF HEATING SYSTEM.

The heating system in general for the Capitol building may be separated into three general divisions, direct radiation being used to supply heat to the Senate chambers and adjoining rooms in one wing and to the House of Representatives chambers and adjoining rooms on the other, while the dining room, Governor's section and legislative library in the central portion are heated entirely by a hot blast system. In general, the radiators are exposed and located beneath the window sills, while those located in the corridors are recessed behind grilles. The recessed radiators are arranged as shown in the typical case given in Fig. 5. The radiators concealed or recessed in the walls and under window sills are set in galvanized iron enclosures of No. 20 gauge using enclosures consisting of bottoms, tops, ends, backs and front, excepting only the portion occupied by the grilles. Where these recesses occur in the outside walls they are backed with ½ in. asbestos sheets placed over the entire outside surface which is in contact with the wall.

The radiator valves on the hand controlled radiators are at the top of the radiator and are of the graduated control type containing an auxiliary stop valve. Where the radiators are concealed behind grilles the spindle of the valve is connected to an extension piece with two ball joints and the handle carried out and mounted on the face of the grille together with its graduated dial. Each radiator and coil (excepting the indirect stacks), and each drip point in the steam main, is equipped with a nickel plated non-by-passed liquid thermostatic return valve with strainer. On the return connection of each of the indirect stacks a water seal combination air and water relief float valve is installed.

In portions of the attic and in the upper part of the large dome pipe coils are used, these being supplied with drip pans of No. 20 gage galvanized iron 6 in. deep and pitched to drain through 1 in. connections into nearby leaders. The coils used in the dome are shown in plan in Fig. 6 and in cross section in Fig. 7.

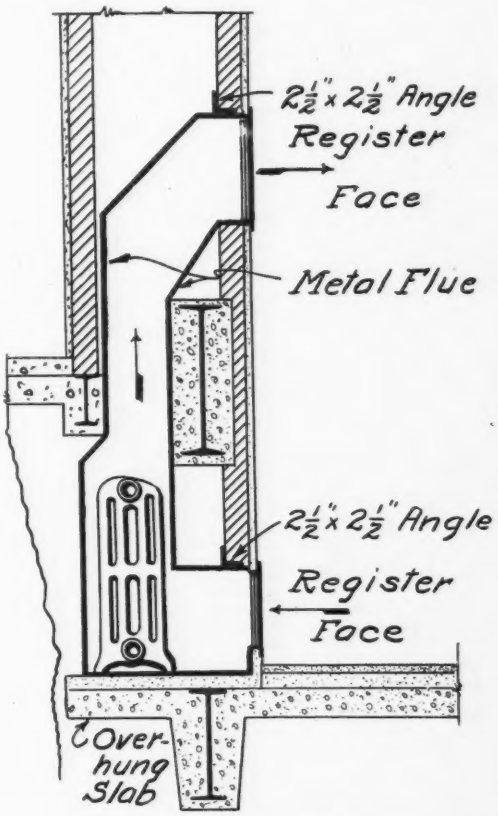


FIG. 5.—PLAN AND ELEVATION OF TYPICAL CONCEALED RADIATOR, MISSOURI STATE CAPITOL.

They are arranged in three tiers 5 ft. apart, each quarter of the dome having three coils 60 ft. long with six rows of 1½ in pipe.

The direct radiators are in general of a plain style and hot water pattern arranged with the various number of columns and heights as required, some of the window radiators being of the Rococo pattern. In certain locations, where space was limited, pressed steel radiators were used.

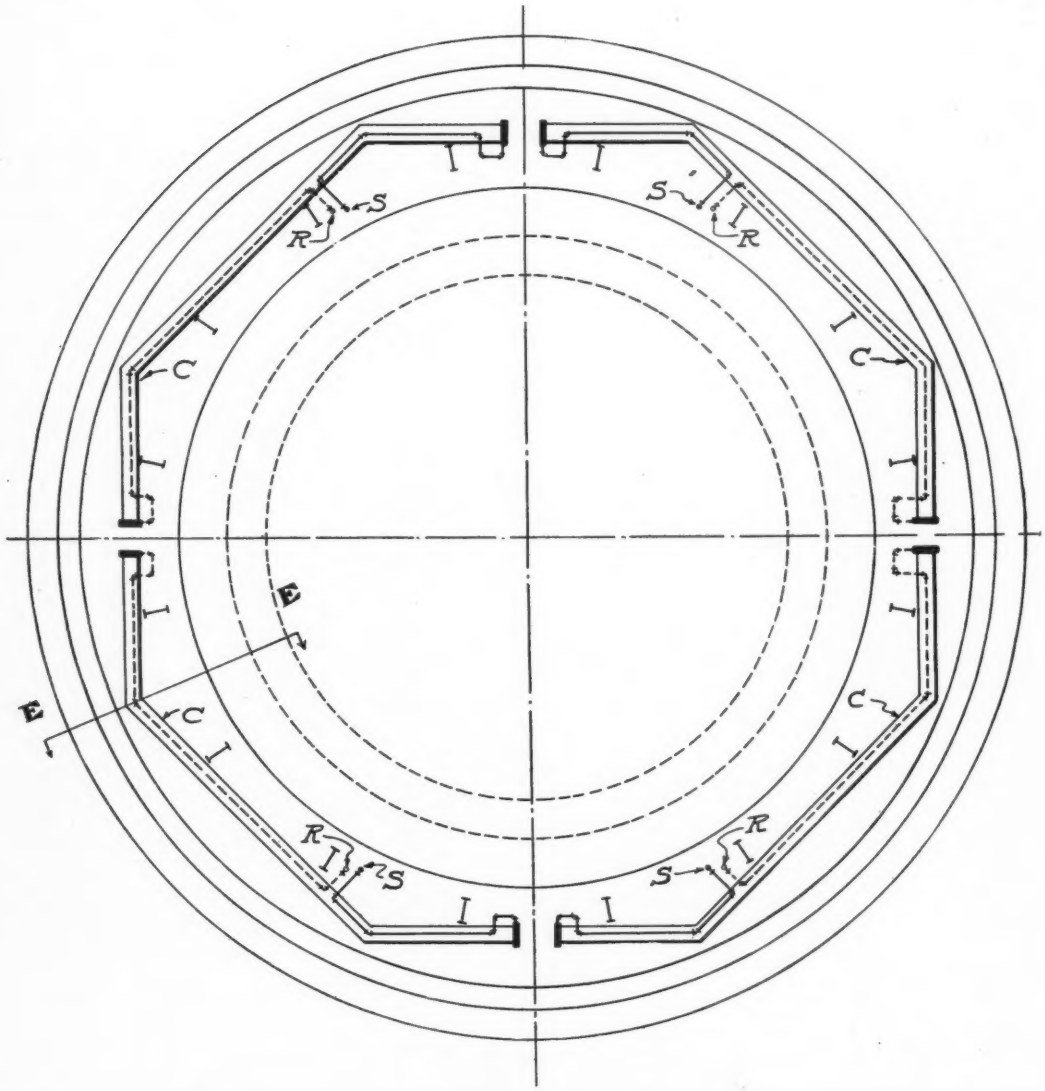


FIG. 6.—PLAN OF DOME COILS, MISSOURI STATE CAPITOL.

The steam pipes throughout are pitched about 1 in. in 10 ft. and the return lines 1 in. in 15 ft., excepting the large steam main in the basement of the Capitol building which is run practically level and dripped through the runouts which are pitched 1 in. in 8 ft.

Where reductions in sizes are made in the steam main eccentric reducers are used, these being located approximately 18 in. beyond the branch causing the reduction. Standard weight pipe is used throughout with standard weight fittings for all low pressure lines except on the blowoff piping. The 14 in. high pressure boiler drum is made of extra heavy pipe and pipe bends of full weight pipe. The standard weight fittings in the power house of 4 in. and larger in size are flanged. Extra heavy fittings are used on all lines 2½ in. and above for high pressure, those 4 in. and over being long turn pattern and flanged.

The following sizes of supply and return pipe connections are made to the various radiators.

Supply Valve. Inches Diam.	Run out. Inches Diam.	Surface. Sq. Ft.	Return Valve. Inches Diam.	Run Out. Inches Diam.
½	¾	0-25	½	½
¾	1	26-75	½	¾
1	1¼	76-125	¾	¾
1¼	1½	126 and over.	¾	1

Runouts over 5 ft. in length are made one size larger, reducing at the radiators.

The total amount of direct radiation installed is as follows:

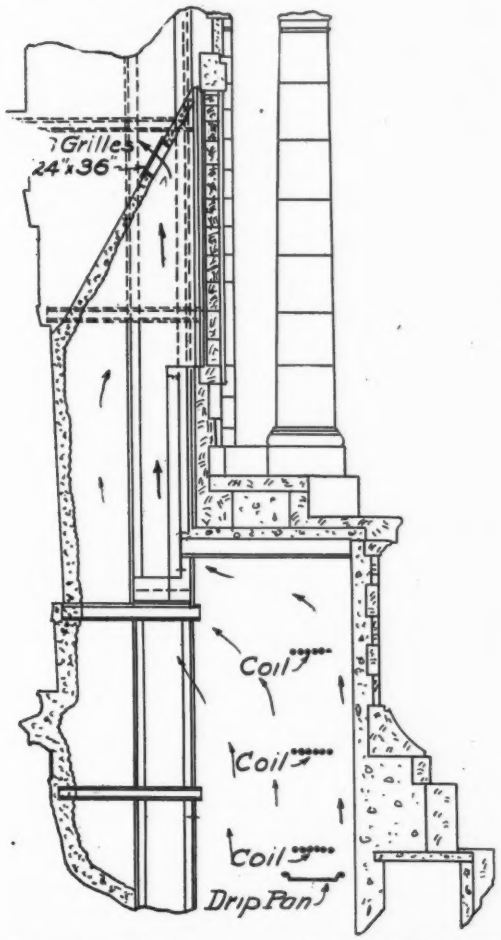


FIG. 7.—SECTION E-E, DOME COILS, MISSOURI STATE CAPITOL.

Ground floor	7,240 sq. ft.
First floor	5,080 sq. ft.
Second floor	3,043 sq. ft.
Third floor	5,166 sq. ft.
Attic, dome coils and library	5,052 sq. ft.
Total	25,582 sq. ft.

Automatic control is applied to the principal rooms, the radiators automatically controlled being equipped with diaphragm valves. The thermostats are of the intermediate action type. The thermostatic system is being installed by the Standard Regulator Co. and is operated by compressed air supplied by two vertical steam-driven air compressors supplying air to a storage tank from which it is piped through the tunnel to the Capitol building.

A system of intermediate pressure mains is also extended through the basement of the Capitol building from the power house tunnel outlet, this steam being used for cooking in the kitchens and for other purposes in the four laboratories.

All steam pipes throughout the work are covered with 85% magnesia sectional pipe covering.

The return pipes are covered with air cell covering. The covering on the high pressure pipes 6 in. and above in the power house and tunnel is 1½ in. thick and elsewhere is 1 in. thick, excepting on the return risers and runouts where it is ¾ in. thick. The covering of screwed fittings is asbestos cement felting while the body of all flanged fittings and valves 2½ in. and larger is covered with similar asbestos cement felting canvassed. Flanges are covered with removable and replaceable flange coverings jacketed with 10 oz. canvas.

The various fans and capacities as installed in the Capitol building are as follows:

	Double Width. C. F. M.	H. P. Motor
For Senate supply	30,000	20
For Senate exhaust	33,000	16
For House of Representatives supply	37,000	25
For House of Representatives exhaust	38,500	18
For Governor's section supply and exhaust (each)	16,000*	20
For east toilet rooms exhaust	6,600	4
For west toilet rooms exhaust	7,100	5
For west kitchen exhaust	3,500	2

*Single width.

The Vento heaters installed for the Senate supply system consist of 72 sec-

tions of 60 in. Vento arranged two groups high, two groups wide, and two rows deep for a tempering heater and 108 sections 60 in. high arranged two groups high, two wide and three deep for a secondary heater. The House of Representative tempering heater consists of 84 sections of 60 in. heaters arranged two groups high, two wide, and two deep. On the secondary heater 126 sections are used arranged two groups high, two wide and three deep.

In the Governor's and library portion a total of 32 sections of 60 in. Vento heaters are used on the tempering coil arranged one high, one wide and two deep, while the secondary heater has exactly double this arranged four rows deep.

ARRANGEMENT FOR REVERSING SYSTEM.

Rotating dampers are placed in the main supply and exhaust ducts for both the House of Representatives and the Senate so that the supply and exhaust air may be reversed at this point in such a manner that all the top registers will be supply registers and all bottom regis-

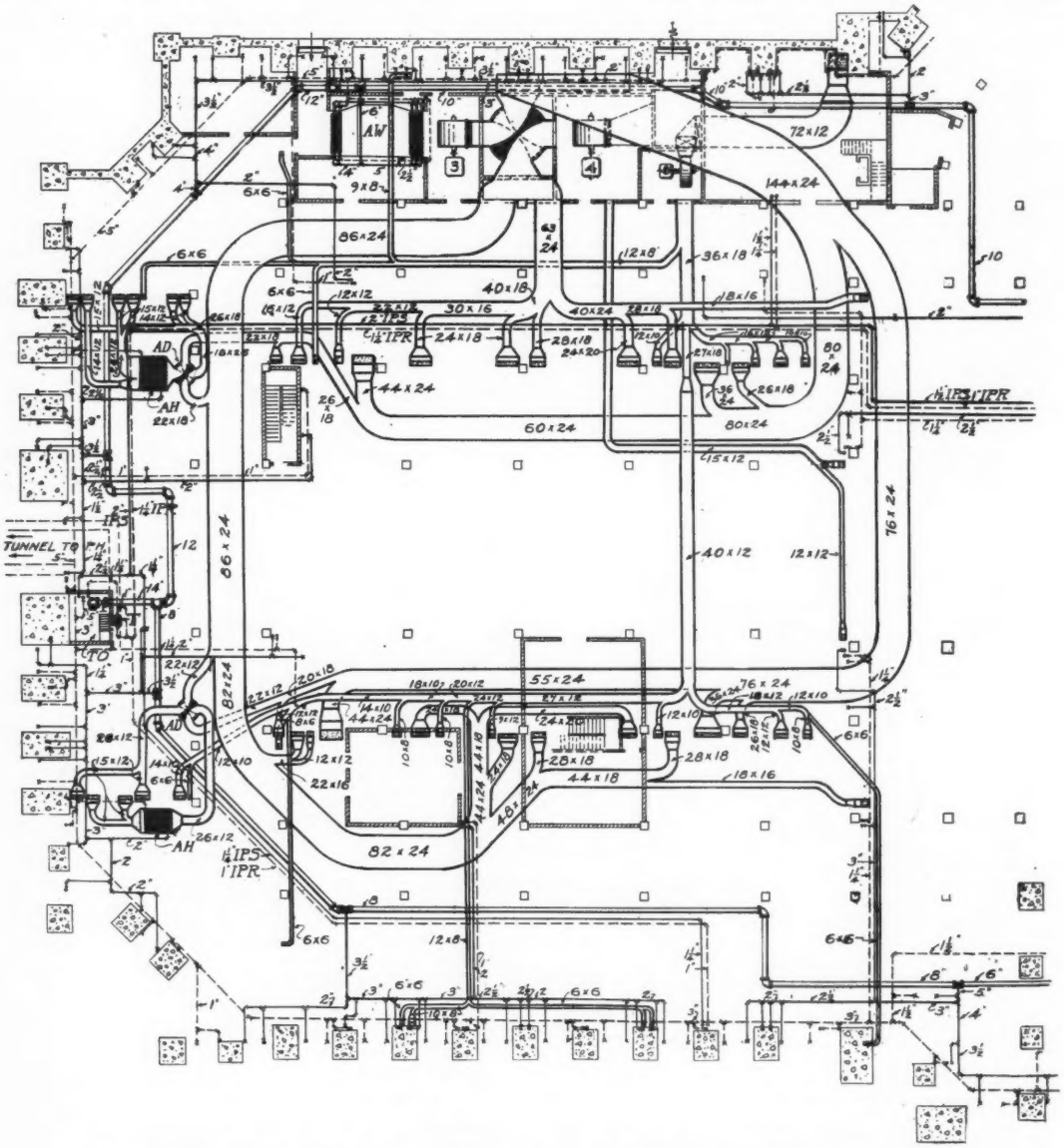


FIG. 8.—PIPING AND DUCT WORK IN BASEMENT OF MISSOURI STATE CAPITOL, SHOWING REVERSING SYSTEM.

ters exhaust registers or vice versa, as desired. Owing to the necessity of using auxiliary heaters in the two groups of ducts going into the lounging rooms it is, of course, impossible to reverse the flow past these heaters without heating the exhaust air coming from the room. This made it necessary to install two smaller auxiliary rotating dampers which operate so as to oppose the change of flow when altered by the main damper. A study of the duct layout shown in Fig. 8 will make this method of reversal clear.

In this figure the air washers are indicated by AW, the auxiliary rotating dampers by AD, the auxiliary heaters for the lounge rooms by AH, and the tunnel outlet to TO. Intermediate pressure lines are marked IPS or IPR according to whether they are supply or return, and a trap is indicated by T.

Apparatus No. 3 is the supply for the House of Representatives, while Apparatus No. 4 is the corresponding exhaust. The fan and motor marked No. 8 are for toilet exhaust on this side of the building. On the opposite side the Senate supply and exhaust is run in a similar manner, the hot blast system used in the central rear portions being situated between the two. In the Senate and House chambers and in the galleries for same mushroom inlets are used, these being fastened to the concrete floor by means of screws driven into plugs in the floor. No. 20 gauge galvanized iron sleeves with a narrow flange on the top are set in the concrete floors connecting the mushrooms with the space below.

The registers and grilles throughout, while in some cases of special design are, in general, plain latticed face; those set in wire lath and plastered partitions and also in terra cotta and concrete walls have cast iron wall frames. Under each floor register is placed a screen of ¼-in. mesh galvanized iron wire bound over a wire frame.

All the supply air used is washed by the use of modern type air washers. They are installed of capacities as shown below.

The velocity of the air through the washers does not exceed 500 ft. per minute in any case.

A vacuum cleaning plant is also installed of a capacity sufficient to operate 12 sweepers simultaneously while still maintaining a vacuum of 12 in. at the pump.

Apparatus No. 1, 32,000 C. F. M. capacity for the Senate.
" " 3, 38,000 C. F. M. capacity for the House.
" " 5, 16,000 C. F. M. capacity for library section.

The Difficulty of Measuring Heat

WITH SPECIAL REFERENCE TO RADIATED AND CONVECTED HEAT.

BY A. H. BARKER, B. SC. AND F. C. S. BRENDAL, B. SC.

(From a lecture delivered at University College, London.)

The general object of the experiments now under discussion is primarily to develop a method of determining a balance sheet of the heat supplied to a room. I wish to explain in some detail the difficulties of this determination, as it forms a very good and instructive example of the kind of difficulties which are always met with in all accurate experiments in heating and ventilation.

It is well known, of course, that heat is supplied to a room in two forms (1) as convection currents of warmed air; (2) as radiated energy proceeding from the hot object, which is usually but incorrectly called radiant heat. Strictly speaking, radiant energy is not heat at all until it is converted into heat by impinging on an absorbent surface.

The inter-relation between these two totally distinct quantities of energy is exceedingly complicated. In the first the measurement of the absolute magnitudes of the two by any direct method is a very difficult process. Further, these two different kinds of energy are capable of being almost instantaneously transformed from one form to the other.

Thus energy radiated into a room from any kind of hot surface becomes immediately converted into heat, by merely impinging on an absorbing surface in the room. Part of that heat can be almost immediately communicated to the air in contact with the surface, so that energy which leaves the hot object as pure radiation, in the course of two or three seconds, may be converted into a stream of warm air rising from the absorbent surface. Part of the energy may also be radiated back again by reflection or by re-radiation.

It is clear, therefore, that if the relative quantities of radiant energy and convected heat are to be measured with any approach to accuracy, it must be under such conditions that this interchange cannot take place before the measurements are made. In any case, the measurement will be one of no ordinary difficulty, partly because this condition of preventing transformation is almost impossible to carry out completely.

It is all but impossible to carry out in practice the condition of keeping to two quantities of energy quite separate until after they are measured. The failure to effect this results in a vitiation of the observations which, unless care is taken to minimize them, may be so serious as to destroy their value altogether. The importance of these observations to the practical heating engineer is not apparent at first sight. If within a few seconds of leaving the hot surface any radiation can be and is transformed into convection currents, what can be the object of taking great trouble to measure the quantities of energy separately?

RADIANT VS. CONVECTED HEAT.

The answer to this perfectly legitimate criticism is that the sensations produced in a room heated by the two methods are altogether different. We can easily conceive an enclosed room heated altogether by convected currents of warm air, indeed this is one of the standard methods of heating a room. It is not by any means easy to conceive a room heated altogether by radiant heat. In the latter case, apart from the effect of what may be called secondary convection currents, the temperature of the air in the room would be the same as that of the air out of doors. The ventilation of the room would be in this sense perfect, that the composition of the inner room air should be the same as that out of doors. There would be no limit to the amount of air that could on this system be passed through a room. How then could one say that a room is heated at all if this condition is fulfilled.

These matters were fully discussed in the public lecture which I gave at the University College some two years ago, on "The Reading of a Thermometer," in which I explained the difference as I conceived it, between what I called the radiant temperature and the air temperature of the room, and I exhibited instruments we had devised for measuring these two quantities. A room heated entirely or mainly by radiant heat would in cold weather show a relatively high radiant temperature and a relatively low air temperature when measured by these instruments. It is found from observations of these instruments that a method of heating which furnishes a large proportion of its heat in radiant form, secures a high radiant temperature and a feeling of warmth along with a relatively low air temperature and a feeling of freshness.

This, I believe, is the very essence of the problem of satisfactory heating and ventilation. This is the fundamental reason for the importance of this subject, and the reason why this series of experiments were designed when this department was first founded and which we are only now bringing to completion.

ELUSIVENESS OF RADIANT HEAT.

One other reason emphasises the importance of this subject. Energy in radiant form may easily pass through a room in large quantities without warming it at all. A large part of it may pass away through the window glass or be absorbed by a very cold wall only producing a very slight effect on a shielded thermometer in the room, yet the room may feel warm to a person in it so long as the radiant supply of energy continues. It is evident that in making the attempt to analyse the conditions that make up satisfactory heating, the very first step is to develop satisfactory methods of measurement of the quantities of the two kinds of energy employed, and these methods will shortly be described.

Before considering the determination of the radiant energy in detail, we ought first to remember the elementary laws governing that form of energy so far as they are applicable to the case in point. The first is that all bodies at whatever temperature are continually emitting radiant energy proportional in amount to the fourth power of the absolute temperature of their surfaces. When we speak of a certain amount of radiant energy from one hot body impinging on and being absorbed by another cooler body, we are alluding to the difference between the amount emitted by the hot body and absorbed by the cooler body on the one hand and on the other the energy simultaneously emitted by the cool body. The net amount received by the cool body due to the proximity of the hot body, is conveniently spoken of as the radiant energy received, although it is not exactly an accurate way of speaking.

ADVANTAGES OF ELECTRIC RADIATORS FOR TESTING PURPOSES.

Further, we know that when radiant energy proceeds from one point, its intensity at any given distance varies inversely as the square of the distance from the point. When a larger surface than a point emits the energy this law is not strictly obeyed, but in all practical cases it is near enough for our purposes. To repeat, the primary object of these experiments is to ascertain in regard to different methods of heating, what proportion of the total amounts of energy employed is used as radiant heat, and what proportion as convection currents. Of all the different methods of heating, the easiest to test on this basis is the electrical radiator, essentially because electrical measurements are easy. It is easy to determine the total quantity of electrical energy consumed by any appliance whatever by measuring the current and the voltage between terminals. Thus we know with certainty that every electrical heater of whatever kind and however bad it may be, at least converts into heat 100 per cent. of the energy consumed, neither more nor less. In this sense no electrical heater can be more or less efficient than any other. The only problem in the case of the electrical heater is how much of this energy becomes radiant and how much convected.

The case of a water or steam radiator is similar, in that we can ascertain by direct observation how much energy comes into the room altogether. In the case of a water radiator, we have to take the quantity of water passing through the radiator in one hour and multiply the difference of temperature at inlet and outlet. This is a much more difficult and tedious operation than reading an ammeter and a voltmeter.

With such a device as an open fire or a gas fire, we do not even know how much of the energy consumed is converted into heat in the room itself. This measurement is much more difficult still, because we do not get into the room the whole of the energy consumed except in the case of the monstrosities known as "gas radiators."

In the case of an open coal fire, we require at least the following measurements in order to determine the total quantity received in the room itself before we can commence to measure how much of the quantity received is convected and how much radiated:

(1) The exact quantity of coal burned and rate of burning at any given moment.

(2) The exact calorific value of the fuel per pound.

(3) The amount of heat lost to the room in the flue gases.

Each of these determinations presents considerable difficulties, and the net result could only be accurate if each individual observation were accurate. Similar observations would have to be made in the case of a gas fire in order to obtain the total energy employed. This would, of course, as in the coal fire, be the difference between the total energy in the gas, and the total quantity thrown away in the flue gases. The case of water or steam radiators is in practice almost as difficult. It involves simultaneous observations on the quantity of water flowing through the radiator, the difference of temperature between flow and return, and it would involve the keeping of all these factors quite constant during the experiment.

With an electrical stove with which we are chiefly concerned tonight, the gross energy is also the net energy brought into the problem. There is nothing to be al-

lowed for heat lost in the flue gases, because there are no flue gases. Although, however, the observations in the case of the electrical radiator are easiest, they are certainly, so far as the practical heating engineer is concerned, less important than almost any other forms of heating, because owing to the high cost of electrical energy at the present time, it is much less frequently employed than is the case with the other forms of heating with which we have to do.

MEASURING RADIANT ENERGY.

The obvious method of measuring the amount of radiant energy passing through any given square foot of space is to allow the radiant energy to impinge normally on a black absorbent surface of carefully measured size, the surface being of such a character that the amount of heat communicated to it can be readily measured. This will absorb the whole of the radiant energy impinging on it and convert it into heat. Such a service is provided by the apparatus known as Smith's radiometer. It consists of a single coil of square section pipe through which water is allowed to flow, formed into a square foot of flat surface. The quantity of water flowing through the coil per hour multiplied by the difference of temperature between the water entering and leaving the coil represents the total amount of energy gained by the coil per hour converted into thermal units.

The drawback to this method is its extreme tediousness. To make one single observation occupied perhaps half an hour. There are further corrections to be made for the following reason: What is actually measured by this radiometer is the total quantity of heat which the surface receives from all sources. That heat may be communicated not only by the absorption of radiant energy, but also by the contact of air.

If therefore the temperature of the water in the coil is in any degree different from that of the surrounding air a change in temperature will be produced in the water passing through the coil, even when no net radiant energy is impinging on it. In order to correct for this possible source of error, there are two practical methods: (1) so to adjust the temperature of the water that the entering temperature is as much lower than the surrounding temperature as the leaving temperature is higher, that is to say, to make the mean temperature of the water in the coil the same as that of the surrounding air. This method, however, is highly inconvenient, as it involves a great deal of adjustment.

The second method is to make a correction by continuing the experiment on the radiometer after the source of radiant heat is withdrawn, and so to determine what may be called the co-efficient of transmission for the radiometer. Then ascertain by calculation what is the total amount of heat lost or gained by the radiometer per degree difference of temperature between the air and the coil, and add or subtract this to or from the result of the other observation.

All these manipulations with the radiometer are excessively tedious, and some more much rapid method is desirable whereby a long series of readings can be taken in a brief space of time. Such a method is at hand in the thermopile, which is an instrument well known but little used by the physicists.

(*To be continued.*)

How Radiant Heat from Gas Radiators is Determined

In discussing the use of gas radiators for heating churches, offices, restaurants, or similar rooms during periods of relatively mild weather, at the recent annual meeting of the American Society of Heating and Ventilating Engineers, George S. Barrows, a member of the Committee on the Utilization of Gas Appliances of the American Gas Institute, was asked how the efficiency of a gas radiator was determined, and what 100 per cent. efficiency would mean.

Replying to this inquiry, Mr. Barrows stated that 100 per cent. efficiency would mean the utilization for heating purposes, of all the energy in the gas. Any properly designed gas burner will give perfect combustion, that is, all of the

energy in the gas available in the form of heat will be delivered to the room. This will mean 100 per cent. of the energy is liberated in the room, but does not mean this energy is utilized in the best manner for heating the room or the persons therein.

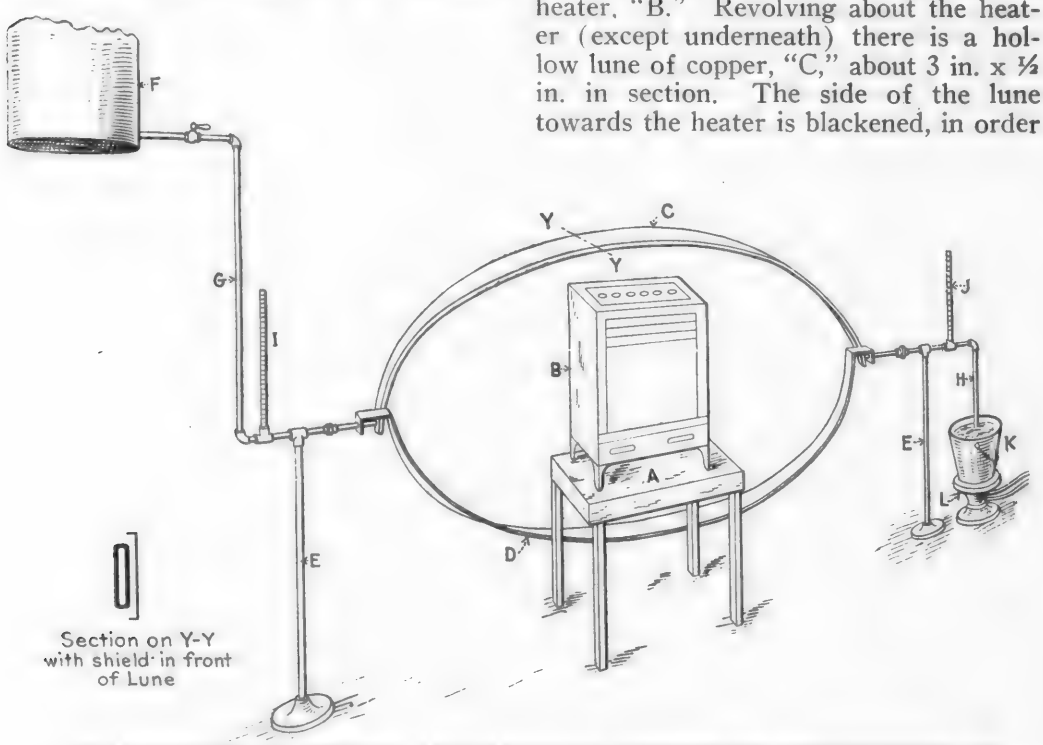
The value of the heater will be governed entirely by the method in which the heat generated is utilized. For instance, if a room is a high one with many windows or thin walls, in an exposed situation, most of the heat is delivered from the heater in the form of heat of convection. This heat will rise, and because it will be rapidly dissipated after heating the walls and ceiling, the practical efficiency of the heater will be small.

If, on the contrary, the heater delivers most of its energy in the form of radiant heat, and it is placed in a location central to the position of most of the occupants of the room, then its practical efficiency will be high.

For the purpose of studying the effect of various heaters, a series of tests has been inaugurated to plot the distribution of radiant heat and hot air convection currents. Unfortunately, other matters of more pressing importance have prevented the carrying of these tests to their conclusion, and no work has been done on the study of convection currents. Some work has been done on the distribution of radiant heat.

To measure this heat, a special form of calorimeter was devised, and a diagrammatic sketch of this piece of apparatus is appended.

A wooden stand, "A," supports the heater, "B." Revolving about the heater (except underneath) there is a hollow lune of copper, "C," about 3 in. x ½ in. in section. The side of the lune towards the heater is blackened, in order to absorb as large a proportion as possible of the radiant energy which falls on it.



ARRANGEMENT OF TESTING APPARATUS TO DETERMINE DISTRIBUTION OF RADIANT HEAT AND HOT AIR CONVECTION FROM A GAS RADIATOR.

A shield, "D," of bright tin is arranged on the same axes as the axes of the lune, and is used for shielding the lune from the radiation as will be described further on.

The lune and its shield are supported on the stands, "E," by means of the pipe axes, "G" and "H." "G" leads from the water supply "F," and "H" is an outlet to a bucket, "K," on the pan of a scale, "L." The thermometer, "I" and "J," give the temperatures of the inlet and outlet water.

To operate, the heater is lighted and allowed to burn until it has reached a uniform temperature. Water is then allowed to flow from the tank through the lune. The lune is set in any desired position above the heater, horizontally opposite the center of it, or at any angle, and the rise in temperature of the water through the lune is observed by means of the two thermometers, the water being weighed to determine the number of heat units absorbed with that particular position of the lune.

The rise in temperature of the water shows the total amount of heat, both radiant and convected, that is absorbed by the water in passing through the lune.

The shield is then turned so that it is between the heater and the lune, and other readings in the rise of the temperature of the water are noted. As the shield intercepts most of the radiant heat, the rise in temperature of the water in this case is only due to the heat of convection.

Subtracting the heat units absorbed by the water from the heat of convection, from the total heat units absorbed by the water, will give the heat units absorbed from the radiant heat.

By moving the lune into a number of different positions, the distribution of the radiant heat is obtained.

The Work of the Chicago Ventilation Commission

Through the publication of a report covering the activities of the Chicago Commission on Ventilation from the date of its organization in 1910 to date, many details of the commission's investigations are made public, in addition to those already published. Included in the report are tests made by the commission on the ventilation of passenger cars, picture theatres, an experimental school room and with an experimental cabinet. The opinions of the commission on phases of ventilation are set forth in resolutions.

One of the most important experiments was that made in an experimental school room, which has already been described in our columns. This room, it will be recalled, was especially fitted up as an experimental room. An airtight falsefloor was built about 18 inches above the regular floor of the room and a false ceiling was hung about 8 inches below the room ceiling. The results of experiments made under these conditions were presented in detail in THE HEATING AND VENTILATING MAGAZINE for December, 1913.

THE COMMISSION'S LATEST INSTALLATION.

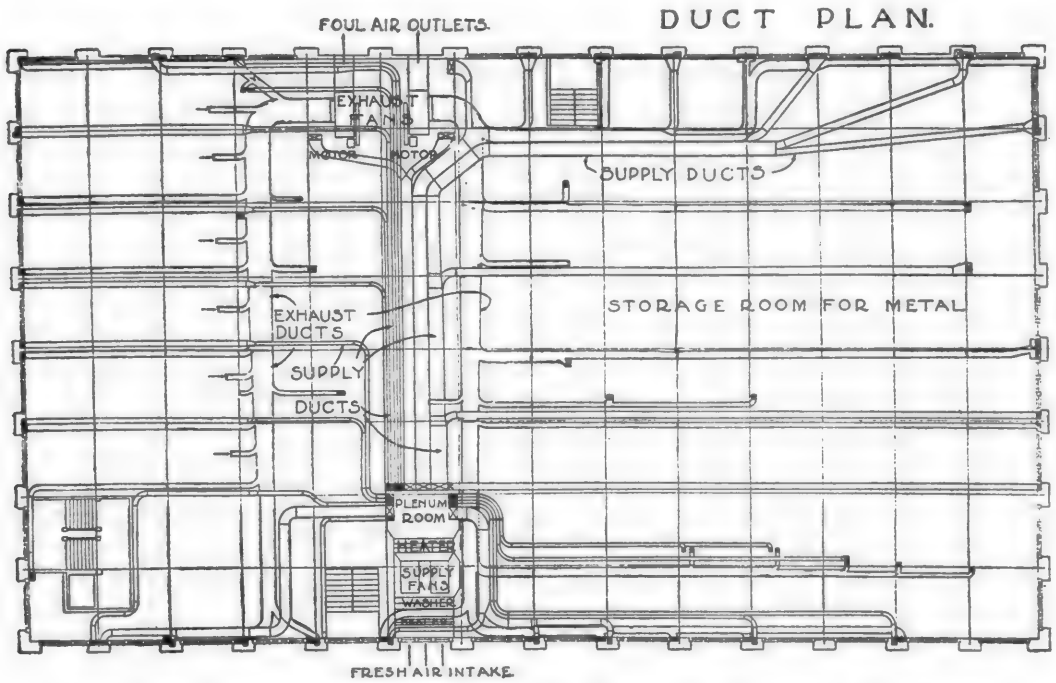
The report states that the commission's first attempt at insuring an equitable distribution of air for ventilation purposes within the experimental room led to a more permanent installation. In the new installation the heating of the experimental room has been separated from the ventilating, in so far as they seem to impair the efficiency of each other. The scheme in brief consists in bringing the air for ventilating purposes into the room through galvanized iron ducts insulated with asbestos and located under the false floor. This system of ducts terminates in 3-in. iron pipes securely fastened to the floor and leading up under the desks. The room is heated by means of hot air driven under the floor. The idea in this scheme is to warm the floor. In order to reduce the effect of window chill, double windows are to be installed, and the heated air from under the floor will be forced upward between the two sets of windows and thus effectually overcome window chill. As in the older installation, the air comes in below the desks and leaves the room through twelve registers in the false ceiling. The air used for ventilating, being introduced through separate insulated ducts, may be at a much lower temperature than that of the air used for heating.

TEST OF AIR CONDITIONS IN OFFICE BUILDING.

Another test reported by the commission was made April 9, 1914, at the office of Joseph T. Ryerson & Son, in Chicago. This consists of a general office, covering the top (third) floor of the building. It is one large room, with a

EXPERIMENTAL SCHOOL ROOM IN CHICAGO NORMAL COLLEGE.

DESK IN EXPERIMENTAL SCHOOL ROOM, SHOWING INDIVIDUAL AIR SUPPLY.



DUCTS AND APPARATUS UNDER FLOOR OF OFFICE OF JOSEPH T. RYERSON & SON, CHICAGO.

few adjacent small private offices. The large room has many low partitions, counters, etc. The ceiling is largely of glass, under a sawtooth type skylight. There are normally about 235 occupants.

The system of heating is entirely indirect steam, with both supply and exhaust fans, with air washer and automatic temperature control. The system of ventilation is described as "by dilution." The inlet openings are about 8 ft. above the floor on the outside walls, averaging about 20 ft. apart. The outlet openings are at the floor, in the outside walls and parallel with the inlet openings. Sheet metal ducts connect the various supply and exhaust flues with the fans, being run along the ceiling of the partially heated metal warehouse under the office.

The supply fans consist of two double wide, double inlet, full-housed 8-blade fans, changed, evidently after the original installation, by adding 8 blades about 6 in. wide alternating with the original blades. The fan wheels are 42 in. in diameter and about 42 in. wide at the periphery. Both are on the same shaft and are operated at 292 R.P.M. Were they of the 8-blade type, they should deliver 22,000 cu. ft. of air per minute at this speed. They are delivering, by anemometer test of the tempered air which they handle, about 27,000 C.F.M. This increase is accounted for by the extra blades. The fans are belt driven by a 15-horsepower motor. The exhaust fans have a rated capacity of about 80 per cent. of the capacity of the supply fans and discharge the air exhausted from the office into a storage shed.

Cold air is drawn from three windows, each 4 ft. by 4 ft. 6 in., about 30 ft. above the street. The room inlet openings have horizontal blade diffusers installed by the owner after having had experience with cold drafts. The outlet openings from the rooms are in the side walls. Many are obstructed by furniture. There is no provision for any air removal at or near the ceiling.

The heater is made up of eight rows of 1-in. pipe, controlled by diaphragm (thermostatic) valves, between the air washer and the intake. There are also twelve rows of 1-in. pipe, automatically controlled, between the air washer and the fan. The free area for air passage is 29.2 sq. ft. The total surface is 2,500 sq. ft.

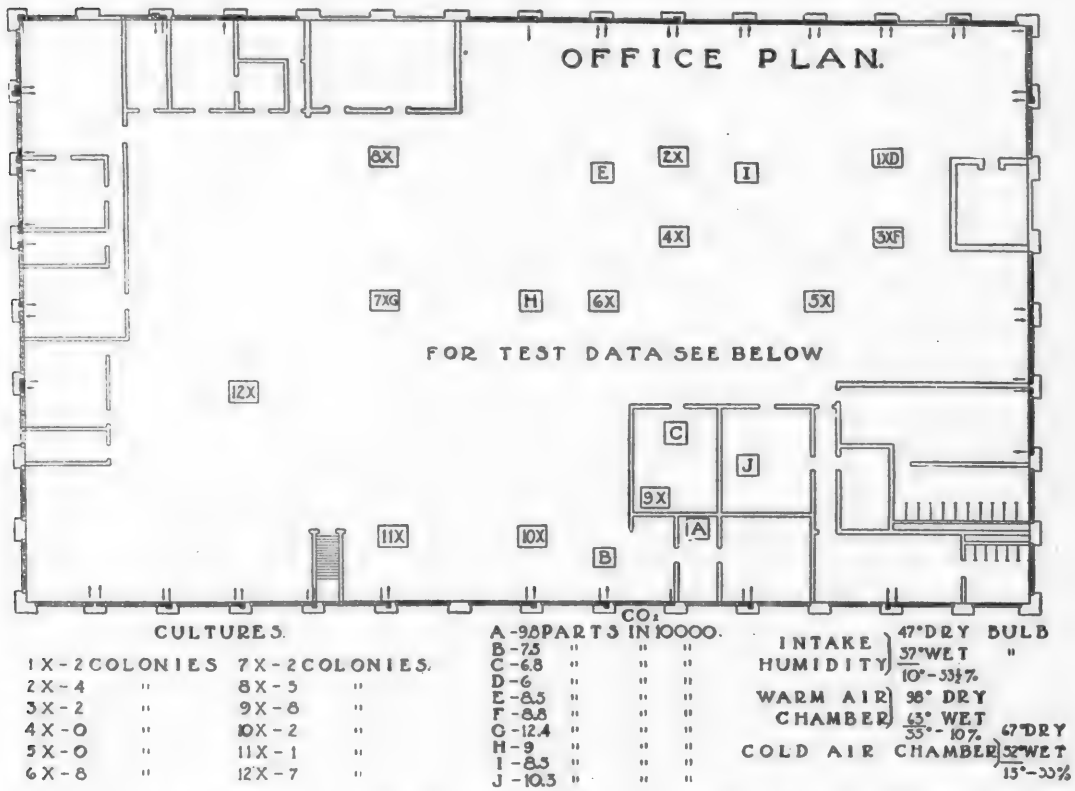
The air washer installed is of the multiple spray type, with automatic water line governor and electric-driven belted centrifugal pump. The iliminators are vertical. No humidity control or means of heating the water is provided. The water was very dirty. The eliminator was coated with dry deposit, ⅛ to ½ in. deep. The washer is 13 ft. wide, 6 ft. high, and 5 ft. paralleling the direction of the air passage.

Ducts are of sheet metal, have very long runs, and are figured for 800 to 1,500 lin. ft. per minute velocity. They are not insulated from each other or from the surrounding air, which often gets as low as 30° F. As the ducts are rather minutely subdivided, with separate automatic mixing dampers in each, the skin friction is considerable.

There are no heating coils between the air washer and the fan, and the tempered air used for cooling the office evidently is often insufficiently heated. By means of double dampers and a complicated series of baffles between the tempered air and hot air chambers, an attempt has been made to warm the tempered air by forcing hot air to mix with it, under thermostatic control.

DETAILS OF TEST.

Time of test, 2 to 5 P. M.
Outside air, 37° F.
At air washer, 46° F.
Air washer water, 46° F.



MAIN FLOOR PLAN, OFFICE OF JOSEPH T. RYERSON & SON, CHICAGO.

Hot air chamber, 98° F.
Tempered air chamber, 67° F.
In the office, average, 72.2°, ranging from 68° to 76° F.
Relative humidity outside, 33.5%.
Average in the office, 38.4%, ranging from 26% up to 50%.

BACTERIA.

Petrie dishes were exposed for two minutes each at the points marked "1X, 2X," etc., on the plans, with the results

shown on the margin, following the index numbers.

AIR DISTRIBUTION.

A. Samples of the air were taken at the points marked "A, B," etc., on the plans, with the results shown on the margin, following the index numbers. The outside CO_2 at the beginning of the tests was 3.8 parts per 10,000.

B. Ammonium chloride formed from the combination of ammonia and hydrochloric acid was introduced into the plenum chamber, to visualize the air distribution.

DUST.

The dust content in the entering air at the supply windows was 5,600,000 per cubic centimeter. Between the washer and the fans it was 4,000,000 per cubic centimeter. In the office, it was 1,600,000 as tested at two representative points.

The plant has been in use about five years. The tempering coils, being exposed to the weather, are very rusty. Several pipes, having frozen, are blanked off. The washer is very dirty.

The fan wheels and housings are covered with oil and dust averaging ¼ in. deep. The plenum chamber and ducts are very rusty. The plant otherwise is in good order. There is considerable discoloration of the walls around the room intakes. The neighborhood of the plant is smoky and dirty.

The average relative humidity was lower than would be desirable, and if an average of 45% had been maintained, greater comfort and a lower temperature would be possible.

The bacteria colonies were very low in number, indicating excellent cleaning in the room, and an ability in the plant to maintain a high efficiency in this regard.

The carbon dioxide analysis indicates a very poor fresh air distribution, as where it showed by this index 12 parts of CO_2 per 10,000 only 750 cu. ft. of air per hour per occupant were being delivered in such localities. For the whole room nearly 6,900 cu. ft. of air per hour per occupant are really delivered.

The air distribution test showed that the greater part of the fresh air supply is being delivered to the north side of the room. The adjustment of the volume dampers which effected this evidently was made in order to warm the room in cold weather, this being especially necessary since the heating plant is on the south, and the supply ducts are run long distances in a very cold place without insulation.

The high dust content at the inlet and the low dust count in the room are striking, especially as the air washer seems to have an efficiency of but 28%.

It may be accounted for by the disturbance of local settled-out dust in the intake and fan rooms by the operatives of the instruments and by the fact that much of the dust so stirred up settled in the fans and ducts before reaching the room.

CONCLUSIONS OF THE COMMISSION.

The owner evidently made and is making a conscientious endeavor to provide the best possible working conditions. The provision of some direct radiation along the north side, or indirect ratiator boosters in the ducts running to the north side, by enabling the room to be heated evenly would permit of a more perfect air distribution, correcting the condition indicated by the CO_2 and air distribution tests. The trouble would be ameliorated by heating the room under the office, or by insulating the ducts.

The supply fans are running very slowly in consideration of the length of the ducts and there is ample power to speed them up to at least 350 R. P. M. The entire air handling mechanism should be thoroughly cleaned at frequent intervals.

The installation of automatic humidity control is not difficult, and would improve the conditions.

The closing of the inlet openings on one side of the room and the closing of all vent openings on the opposite side is suggested for use in warm weather especially, as it is believed that such a procedure would insure a more thorough sweeping with fresh air of the entire area.

For hot weather operation, it would probably be an improvement if ceiling outlets were provided, whereby the hot air accumulating there by reason of the sun effect could be forced directly out by the incoming cooler air.

A similar new plant should be so de-

signed that there will be no long ducts run in cold air, especially to the north side. It should have its vertical flues thoroughly insulated, especially if they must run up outside walls. It should have both floor and ceiling inlets and outlets so that efficient summer operation may be effected.

The various instruments used in this test are described in the report.

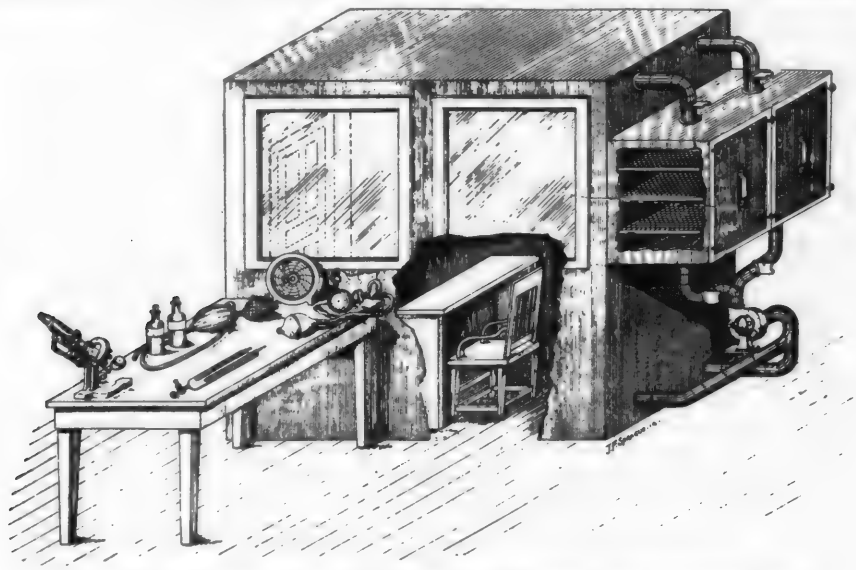
CABINET TESTS.

The accompanying illustration shows the cabinet used by the commission in its cabinet tests. The tests were conducted under varying air conditions, with particular reference to volume, movement temperature, humidity, carbon dioxide, dust and bacteria. It is the intention to repeat the tests with subjects of different types. Thus far the tests have been only of a preliminary nature, to enable the commission to determine the best method of conducting them, and also to determine the best apparatus required to maintain the desired atmospheric conditions.

The cabinet is built of heavy galvanized iron, 28 in. wide, 6 ft. long, and 6 ft. high. All seams are soldered and painted. On one side are two observation windows, each 2 ft. square. At one end is an airtight door, and at the other end is a three-speed direct-connected Sirocco fan, having a maximum capacity of 84 C. F. M. The installation of the fan is such that the air may be re-circulated in the cabinet, or fresh air introduced. The fan discharges the air into the cabinet through either or both of two compartments in which chemicals or other material may be placed for controlling the temperature, humidity, CO_2, etc. In addition to the above a small air washer is about to be installed.

The cabinet easily accommodates two persons. The tests are usually conducted with two subjects of different age and type, at the same time, in order to obtain a check on the effects noted.

Observations are taken, at stated periods throughout the tests, of the air conditions as well as the physical and mental condition of the subjects.



TEST CABINET USED BY THE CHICAGO COMMISSION ON VENTILATION.

The Chicago Commission on Ventilation, as now constituted, is composed of George B. Young, M. D., and E. V. Hill, M. D., representing the Chicago Department of Health; John Wilkes Shepherd, representing the Chicago Board of Education; Samuel R. Lewis, James H. Davis and H. M. Hart, representing the Illinois Chapter of the American Society of Heating and Ventilating Engineers; George Beaumont, representing the Illinois Chapter of the American Institute of Architects; Meyer J. Sturm, representing the Illinois Society of Architects, and Fred J. Postel, representing the Western Society of Engineers.

The Performance and Selection of Centrifugal Fans

DATA AND NOTES APPLYING TO BOTH STEEL AND MULTIVANE TYES.

BY THE LATE FRANK L. BUSEY.

(*From a Paper Presented at the annual meeting of the American Society of Heating and Ventilating Engineers, New York, January* 20-22, 1915.)

II.—FAN SELECTION.

It has been the custom until recently for the fan builders to issue capacity tables of their fans based on total pressure and giving the fan performance at its rated point—that is, the point of highest total efficiency. The growing custom of specifying static resistance has led to the publication of static pressure capacity tables for many of the fans now on the market, and in some cases these tables are arranged to give the fan performance at other than its rated point. Such tables have been issued for the Sirocco and for the Niagara Conoidal fans. As these tables may apear somewhat puzzling to one not familiar with their use, a brief explanation of their application in the selection of a fan may prove of interest.

The sample capacity tables here shown are taken from the tables of the Niagara Conoidal fan, and are based on the performance curves shown in Figs. 6 and 7. Table II is a reproduction of what might be termed the rated capacity table, giving the capacity, speed and horsepower of the different sizes for different total pressures, when operating at what has been selected as the rated point on the curves. This is approximately the point of highest efficiency. These tables are similar to practically all of the fan tables heretofore published and require no particular explanation.

Table III is one of a set which, like the recently published tables for the American Sirocco, may at first appear puzzling to one inexperienced in their use. While Table II gave the performance of all sizes at the most efficient point only, this one gives the performance for one size only, but all along the curve on both sides of the most efficient point.

TABLE II.

CAPACITIES OF BUFFALO NIAGARA CONOIDAL FANS (TYPE N) UNDER AVERAGE WORKING CONDITIONS—AT 70° F. AND 29.92 INCHES BAROM

Fan No.	Mean Dia. of Inlet Wheel.	Area of Outlet. Sq. Ft	⅜ In. Total Press or 0.217 oz			½ In. Total Press or 0.288 oz			⅝ In. Total Press. or 0.361 oz.			¾ In. Total Press. or 0.433 oz.		
			R.P.M.	Vol	H.P.	R.P.M	Vol	H.P.	R.P.M.	Vol.	H.P	R.P.M.	Vol.	H.P.
3	15⅝	1.31	413	1490	0.13	478	1720	0.19	533	1930	.27	585	2110	0.35
3½	18⅛	1.79	354	2030	0.17	409	2350	0.26	457	2620	0.37	501	2870	0.48
4	20½	2.33	310	2650	0.22	358	3070	0.34	400	3430	0.48	439	3750	0.63
4½	23½	2.95	276	3360	0.28	318	3880	0.43	356	4340	0.60	390	4750	0.80
5	26⅛	3.64	248	4150	0.35	287	4790	0.53	320	5350	0.74	351	5870	0.98
5½	28¾	4.41	225	5020	0.42	260	5800	0.65	291	6470	0.90	319	7100	1.19
6	31⅜	5.25	207	5970	0.50	239	6900	0.77	267	7710	1.07	292	8450	1.41
7	36½	7.14	177	8130	0.68	205	9400	1.05	229	10490	1.46	251	11500	1.92
8	42	9.33	155	10610	0.89	179	12260	1.37	200	13700	1.91	219	15020	2.51
9	47	11.81	138	13450	1.12	159	15520	1.78	178	17340	2.41	195	19000	3.18
10	52	14.58	124	16580	1.39	143	19160	2.14	160	21400	2.98	175	23460	3.93
11	58	17.64	113	20070	1.68	130	23180	2.58	146	25900	3.60	160	28390	4.75
12	63	21.00	104	23880	2.00	119	27590	3.08	133	30820	4.29	146	33780	5.65
13	68	24.65	95	28040	2.35	110	32370	3.61	123	36180	5.03	135	39650	6.63
14	73	28.68	89	32520	2.72	103	37550	4.19	114	41950	5.84	125	45990	7.69
15	78	32.80	83	37330	3.13	96	43100	4.80	107	48160	6.70	117	52790	8.83
16	84	37.32	78	42470	3.56	90	49040	5.47	100	54790	7.62	110	60060	10.1
17	89	42.14	73	47950	4.01	84	55370	6.17	94	61860	8.60	103	67800	11.4
18	94	47.24	69	53750	4.49	80	62060	6.92	89	69340	9.64	98	76010	12.7
19	99	52.63	65	59890	5.00	75	69160	7.71	84	77260	10.8	92	84700	14.2
20	105	58.32	62	66360	5.56	72	76640	8.54	80	85600	11.9	88	93850	15.7

Static pressure is 77½% of total press

TABLE III.

NO 10 NIAGARA CONOIDAL FAN (TYPE N).
Capacities and Static Pressures at 70° F and 29.92 In. Barom

Outlet Velocity Ft.-Min.	Capacity Cu. Ft. Air Per Min	Add For Total Press	½ In. S.P		¾ In. S.P.		1 In. S.P		1½ In. S.P		2 In. S.P.	
			R.P.M.	H.P	R.P.M.	H.P	R.P.M.	H.P	R.P.M.	H.P	R.P.M.	H.P
1400	20410	0.122	164	2.92	206	4.61	243	6.59	308	11.1		
1500	21870	0.141	163	3.13	204	4.78	240	6.83	305	11.5		
1600	23330	0.160	164	3.42	202	5.02	238	7.05	302	11.8	357	17.0
1700	24790	0.180	165	3.74	201	5.30	235	7.28	299	12.1	353	17.5
1800	26280	0.202	166	4.13	200	5.61	233	7.59	295	12.4	350	17.9
1900	27700	0.225	168	4.55	200	6.01	232	7.91	293	12.7	347	18.3
2000	29160	0.250	171	5.04	200	6.48	231	8.32	291	13.0	343	18.7
2100	30620	0.275	174	5.56	201	7.00	231	8.77	288	13.5	340	19.2
2200	32080	0.302	177	6.12	203	7.54	230	9.31	286	13.9	338	19.6
2300	33540	0.330	180	6.76	205	8.16	231	9.92	285	14.4	336	20.1
2400	34990	0.360	183	7.43	207	8.86	232	10.6	284	15.0	332	20.6
2600	37910	0.422	190	8.95	213	10.4	235	12.1	282	16.3	329	21.8
2800	40830	0.489	198	10.7	219	12.2	240	13.9	283	18.1	327	23.3
3000	43740	0.560	206	12.7	226	14.3	246	16.0	285	20.1	326	25.0
3200	46660	0.638	215	14.8	234	16.7	251	18.3	288	22.4	327	27.4

Note· Bold-face figures indicate point of highest static efficiency

164	2.92	201	5.30	231	8.32	284	15.0	327	23.3
		200	5.61						

There is one point in each pressure column at which the fan will give its best efficiency, indicated on the table by the boldfaced figures. For each pressure there is a certain velocity through the outlet that will give the best efficiency, as for instance, 2,000 velocity for one inch static, and this holds true for all sizes. It may often be a matter of expediency to operate a fan at other than this most efficient point, and we will consider this question more in detail later.

HOW TO USE TABLES

A question frequently asked concerning these tables is how will one find the performance of a fan *at any other than the pressures given in the tables.* When using the regular tables of rated capacities we are accustomed to work directly across the table for each size, and find that for different pressures the speed and capacity vary as the square root of the pressure, and the horsepower as the three-halves power. In the case of these new tables, we cannot work directly across, since each line represents a constant capacity. By working diagonally across the table, that is, by *finding in the capacity column a new air quantity proportioned as the square root of the pressures* and then following across the table to the desired pressure column, we will find the required speed and horsepower.

As an example, we will assume it is desired to handle 31,000 cu. ft. of air per minute at 1¼ in. static and we wish to know the speed and horsepower of a No. 10 fan for this purpose. The table gives the data required at once inch, so we multiply 31,000 by the square root of the ratio of 1 in. to 1¼ in. and find the corresponding capacity when reduced to a one-inch basis to be 27,700 A.P.M. From the table, the speed at one inch will be 232 R.P.M. and require 7.91 H.P. The speed for the required capacity at 1¼ in. pressure will vary from the above directly as the capacity, and the power as the cube of the capacity. The No. 10 fan will then handle 31,000 A.P.M. against 1¼ in. static at 260 R.P.M. and require 11.1 H.P.

Perhaps the most important function of this new set of tables is to enable one to select different sizes of fans for any desired duty, and to tell at a glance the corresponding speed and horsepower. The table here shown is a composite, giving the performance of three sizes of fans, each operating against a static resistance of one inch. As mentioned before, when operating at one inch static the highest static efficiency will be attained with an outlet velocity of 2,000 ft. per minute.

These outlet velocities tend to aid in the selection of a fan, inasmuch as it is good practice to use certain velocities with installations of different character. Thus in the case of schools, where quiet

operation is absolutely essential, an outlet velocity of from 1,800 to 2,200 should be used. As the static resistance of such an installation will seldom run over one inch, we note that this is also the point of highest efficiency. In the case of a shop where some noise is not so objectionable, where high duct velocities will be used, and where the static resistance will probably approach two inches, an outlet velocity of perhaps anywhere between 2,800 and 3,400 may be used. For special cases we may use either higher or lower velocities, according to the requirements to be met. But for schoolhouse work one would seldom be warranted in using over 2,200 outlet velocity. By a comparison of the three sets of data in Table IV, it will be seen how we may select either one of the three fans for the same duty. Assuming that we are required to supply 15,000 cu. ft. of air per minute at one inch static, the bold-face figures show that we may use the No. 6 at 400 R.P.M.; the No. 7 at 330 R.P.M.; or the No. 8 at 298 R.P.M. The No. 7 will come the nearest to the most efficient point, requiring less power than either of the others.

In case we expect to use high duct velocities and are interested in first cost rather than economy of operation, the No. 6 would be the fan to use. If low operating cost is the most essential factor to be considered and moderate velocities are allowable, the choice should fall on the No. 7. But in case very low velocities are absolutely necessary, even at a higher initial cost and a slight increase in operating cost, the No. 8 fan should be used.

One of the questions frequently asked by any one using these tables for the first time is how is it that we expect to get two different capacities at the same speed, when we have always been taught that the speed varies as the capacity. As will be seen from the table, each size of fan will deliver two different quantities of air at the same speed with a constant static resistance. But we must also note that the total pressure is different for each case. This means we would be operating at two different points on the performance curve. We have already noticed from Fig. 8 that one of the peculiar features of the pressure curve of this fan is what we might call the hump, or high spot. Now this curve was drawn for a varying capacity but a constant speed, so that over a certain range there will be two capacities for the same speed and pressure, hence the two capacities in the table.

Perhaps the simplest way to illustrate this point would be to show that each installation has a certain definite coefficient of resistance and that the quantity of air handled is a direct function of this coefficient and the static resistance of the system. As shown in Fig. 9, the relations holding in the case of a fan

TABLE IV.—SPEED AND HORSE-POWER OF NIAGARA CONOIDAL FANS, AT VARIOUS CAPACITIES AND ONE INCH STATIC PRESS.

Outlet Velocity Ft.-Min.	Add Total for Press. Inches	No. 6			No. 7			No. 8		
		Capacity, Cu. Ft-Min.	R.P.M.	H.P.	Capacity, Cu. Ft-Min.	R.P.M.	H.P.	Capacity, Cu. Ft-Min.	R.P.M.	H.P.
1600	0.160	8400	397	2.54	11430	340	3.46	**14930**	**298**	**4.51**
1700	0.180	8920	392	2.62	12150	336	3.57	15860	294	4.66
1800	0.202	9450	389	2.73	12860	333	3.72	16800	291	4.86
1900	0.225	9970	387	2.85	13570	332	3.88	17730	290	5.06
2000	0.250	10500	385	3.00	14290	330	4.08	18660	289	5.33
2100	0.275	11030	385	3.16	**15000**	**330**	**4.30**	19600	289	5.61
2200	0.302	11550	384	3.35	15720	329	4.56	20530	288	5.96
2300	0.330	12070	385	3.57	16430	330	4.86	21460	289	6.35
2400	0.360	12600	387	3.82	17150	332	5.19	22400	290	6.78
2500	0.390	13120	389	4.10	17860	333	5.59	23330	291	7.30
2600	0.422	13650	392	4.36	18580	336	5.93	24260	294	7.74
2800	0.489	**14700**	**400**	**5.00**	20000	343	6.81	26130	300	8.90
3000	0.560	15750	410	5.76	21430	352	7.84	28000	308	10.2
3200	0.638	16790	419	6.59	22860	359	8.97	29860	314	11.7
3400	0.721	17850	432	7.60	24290	370	10.3	31720	324	13.5

NOTE—Bold figures indicate point of highest static efficiency at 1-inch static press.

are directly comparable to those with which we are familiar in the case of electricity. We have, first, the relation of voltage drop or voltage resistance across the terminals is equal to 1^2, a measure of quantity, times R, the coefficient of resistance, this product being known as the 1^2R loss. In the same way, we have the static resistance on the fan which is equal to the square of the air quantity times the coefficient of resistance of the system. By simply changing the position of the factors in this equation we have *the coefficient of resistance of any system is equal to the static pressure divided by the square of the air quantity.* Also the air handled will be a definite fixed quantity, equal to the square root of the static pressure divided by the coefficient of the system. The static pressure is a constant for any certain installation, being a measure of the static resistance against which the fan is to operate. Thus the static resistance on a fan drawing through six sections of Buffalo Standard Pipe Heater would be 0.57 in.

On the diagram, Fig. 9, are drawn two curves representing the coefficient of resistance of two different installations. The horizontal curves represent the static pressure curves for two different speeds. The points of intersection of each diagonal with the horizontal curves indicate what will be the performance of the fan at either speed for either of the two installations. That is, with a coefficient of R_1 and a speed of 235 R.P.M. the fan will deliver 24,800 cu. ft. of air per minute against one inch static, and it will not deliver any other quantity. If a different installation is considered with coefficient R_2, this same fan will deliver 34,200 cu. ft. of air per minute against one inch static, with the same speed of 235 R.P.M. *That is, each fan will deliver, within certain limits, two air quantities at the same speed and static pressure, but not on the same installation.* If we increase the air quantity we increase the velocity and consequently the friction and static resistance. We have changed the conditions of our system and will have a different coefficient R, with the result that we will operate at a different point on the performance curve.

We note that with a constant coefficient, as for instance R_1, if it is desired to handle more air it is necessary to operate at a higher pressure. Thus, if we speed up to 286 R.P.M., we will develop a static pressure of 1.5 in. and deliver 30,100 cu. ft. of air per minute. The ratio of this new static pressure to the square of the air quantity is still the same as that for the first case. That is, the value of R_1 is the same.

CONCLUSIONS.

The practice of specifying the static resistance against which a fan is to operate and then selecting a fan that will give a high static pressure at the fan outlet and a high static efficiency is to be commended. Where only the total efficiency of a fan is given, but the ratio of the static to the total pressure is known, the static efficiency may be calculated by multiplying the total efficiency by the ratio of the pressures.

As has been mentioned before, in making the selection of a fan the choice lies between the older type of straight blade fan, and the newer multivane type. The impression has of late been prevalent among engineers that the multiblade type is inherently more efficient than the straight blade fan, but we have seen that such is not necessarily the case. A properly designed radial vane fan may be made to give even higher efficiencies than can be obtained with a multiblade type, but as already shown such a fan will be much larger in diameter and narrower. The real advantage of the multiblade type is the attainment of fairly high efficiency in a more limited space, which makes it of great commercial value for certain classes of work. In case an increasing pressure is designed with an increasing resistance, it has been shown from the pressure curves that the forward curved type is not applicable unless operated beyond its most economical point. On the other hand, it is frequently desired to maintain a constant or increasing pressure with an increase in capacity. In such cases the forward curved type is the only fan capable of accomplishing the desired results. Another important advantage of the multiblade fan is the fact that its higher speed makes it more suitable for direct connection to motors, or at least gives better pulley ratios than may be obtained with radial blade fans.

District Heating

By S. Morgan Bushnell and Fred B. Orr.

Relation Between Heat Load and Electric Load in Buildings, and Sale of Heating Service.

This series of articles commenced in the January, 1915, issue.

Perhaps there is no question connected with the production of light, heat and power on which there has been expressed more difference of opinion than on the subject of the relation between heat load and electric load in buildings.

For the past twenty-five years and, in fact, ever since the installation of electric lighting plants in private buildings, the extent of the economy gained by using the exhaust steam from the engines for heating the building has been an interesting subject of discussion. Some have claimed that the steam required for heating buildings could be passed through a dynamo and utilized for light and power, thereby making the heat cost a nominal one. Others ignore the fact that low-pressure steam requires nearly as much coal for its production as is required by high-pressure steam and claim that the saving is very small, basing their argument on the fact that it would require from 80 to 100 lbs. pressure to operate the dynamo whereas it would only require about 2 lbs. pressure to heat the building. Many debates have been heard on this subject, each side basing their arguments on various instances which they thought tended to establish their case. Since in most private plants the steam from the boiler flows not only into the high-pressure pipe which delivers the steam to the engines, but also through a reducing valve into a low-pressure pipe which supplies steam for the heating system, and inasmuch as for a long time there were no accurate data available, the question was regarded by many as one of those subjects which, like politics and religion, are often decided more by the natural attitude of the individual than on the basis of demonstrated facts.

While it has been known for a long time that outside temperatures in the morning are usually colder than in the afternoon, and, on the other hand, that the power and lighting requirements are likely to be heaviest in the latter part of the afternoon, it has been impossible to show how far this lack of correlation of heat and electrical demands would affect the result. One of the first attempts to give a rational solution of this problem was included in a paper given by Mr. David Boyden, early in the year 1912, before the American Society of Heating and Ventilating Engineers, in which he took up in a general way the relation between the steam requirements and the electrical requirements of a large department store in Boston. Nearly two years before this, however, some interesting curves were submitted by Mr. A. D. Spencer in connection with central-station systems in Detroit. These curves showed the operation of one of their plants which supplies electricity to the street mains and also supplies exhaust steam to their heating system. They showed that during a large part of the time, electricity had to be supplied to an alternating-current transmission line in order to make the electrical load correspond with the lighting load. In other words, the curves show a large peak in the morning hours caused by the steam requirements, and another peak in the afternoon caused by the electrical requirements. Quoting from Mr. Spencer's paper, we have as follows:

It is further interesting to note in this same report on the cost of using steam in Detroit, that the actual cost per thousand pounds of steam in the station which produces steam only and did not have any electric generating plant was only a very little greater than the cost of producing steam for heat in the station where the steam was also used for providing electrical power. An attempt has been made both in St. Louis and Chicago by the central-station companies in a very small way to generate electricity by isolated plants and feed it into the main central-station system and use the exhaust steam for heating. In order to make this experiment successful, it is

necessary to operate the plants just up to the heat requirements. In other words, the plants feed just enough electricity into the systems to make the lighting load simultaneous with the heat load. This is possible only in cases where there is a large electrical system into which the plants may feed and, while the arrangement helps the showing of efficiency in the plant which furnishes both steam and electricity, the arrangement militates to a certain extent against efficiency in the central-power stations.

RESULTS OF INVESTIGATION BY NATIONAL ELECTRIC LIGHT ASSOCIATION.

In the year 1912 this subject was taken up by the steam committee of the National Electric Light Association. A series of curves was obtained by members of the committee from a number of typical plants. These curves show the actual steam and electrical requirements of those plants on various days during the year. These curves were obtained by measuring the amount of steam used in certain plants which were using central-station service and plotting the steam used in these buildings from the records of the St. John curve-drawing meter. On this same drawing was plotted the simultaneous load curve showing the electrical load required in the same building at different hours of the day.

In order to reduce the electrical curve to its equivalent in steam requirements, it was necessary to assume the number of pounds of steam that would be required per K.W. hour, providing an isolated plant were furnishing this service. The matter was taken up with different engineers and at first it was thought that the ordinary single-expansion engine direct connected to a dynamo would make a unit requiring about 50 lbs. of steam per K.W. hour. In order to make sure, however, this was checked by a number of tests in New York, Chicago and other places in plants of actual operation.

These tests showed a considerably higher average, viz., about 60 lbs. per K.W. hour. In view of the fact that most plants need to operate at night under very light loads, which would mean very low efficiency, and in view of the fact that the average plant is not new, but has been operating a number of years, it was decided that 60 lbs. would be a fair assumption. While it is doubtless true that the efficiency of a small plant would vary from light load to full load, it was not thought best to complicate the problem by trying to compensate for this difference. The average efficiency was assumed as the same throughout the 24 hours.

These investigations have gone a long way towards clearing up the matter under discussion, but there is still room for considerable investigation along these lines. Different buildings vary greatly n their load characteristics. The ordinary high-class theatre giving one or at the most two entertainments per day, would have an entirely different condition from the modern hotel which maintains a very much steadier demand for both light and power. These curves showed that while there was a considerable amount of economy in the use of exhaust steam for heating, the extent of this economy had often been exaggerated. It should be remembered in this connection that these curves show the condition only during the cold weather. During the summer time there, of course, can be no saving, as the premises do not require to be heated, and during the spring and fall the amount of heat required is comparatively small. In order to show the nature of these comparisons, there are shown herewith a number of curves illustrating the relation between the heating and electrical load. These curves include:

Fig. 1 shows the simultaneous steam and electric curve for a large department store in Chicago, on a severe winter day. This store requires a considerable amount of live steam in the summer time for operating a large bank of elevators and for cooking purposes. The steam curve has been determined by various meter readings taken in the summer and the electric curve is therefore superimposed on this steam load. While this introduces a certain amount of estimating in computing the curve, the requirements of the store are pretty well understood and the comparison between the steam and electric curves may be relied upon as practically correct.

Fig. 2 shows the steam load of this particular store on a summer day, also

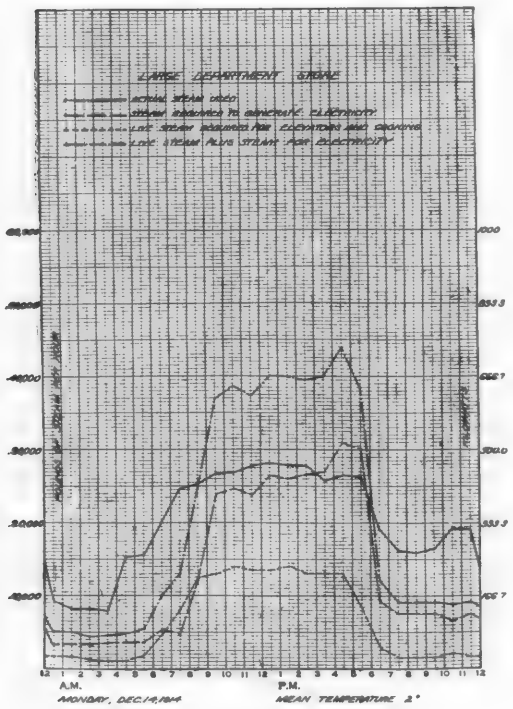


FIG. 1.

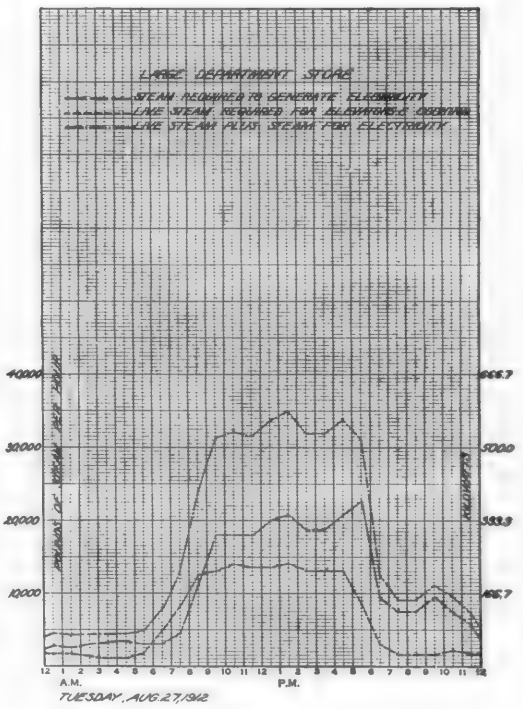


FIG 2.

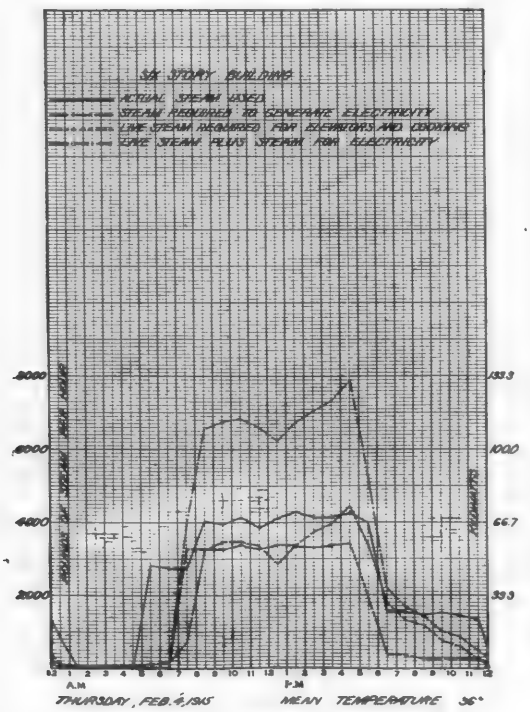


FIG. 3.

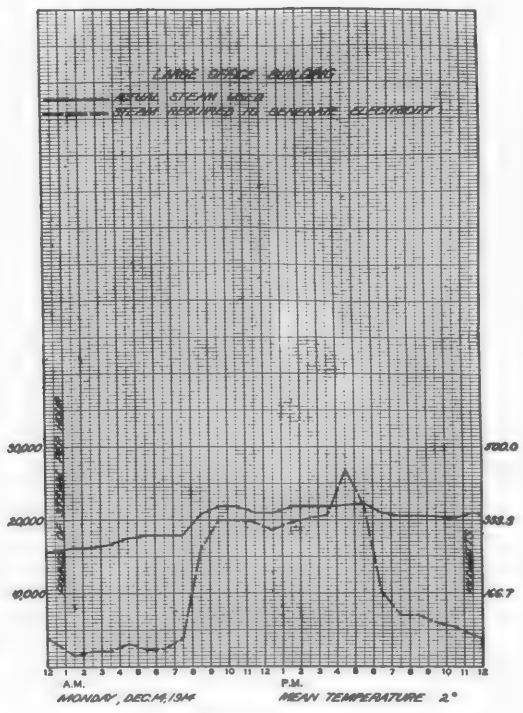


FIG. 4.

LOAD CHARACTERISTICS FOR VARIOUS TYPES OF BUILDINGS.

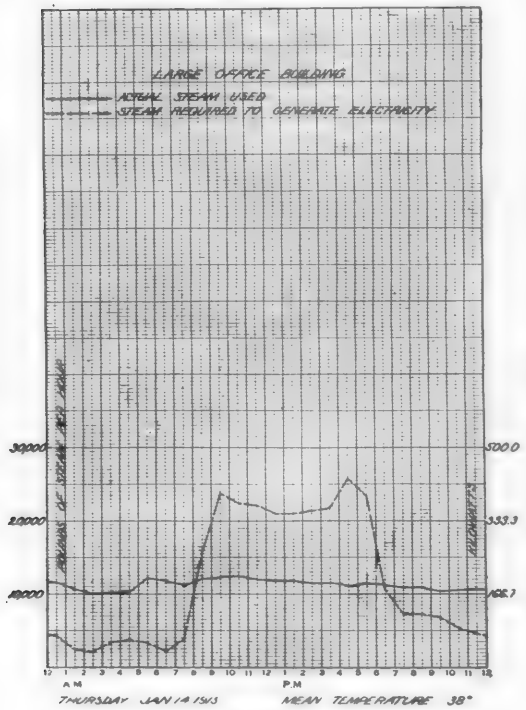


FIG. 5.

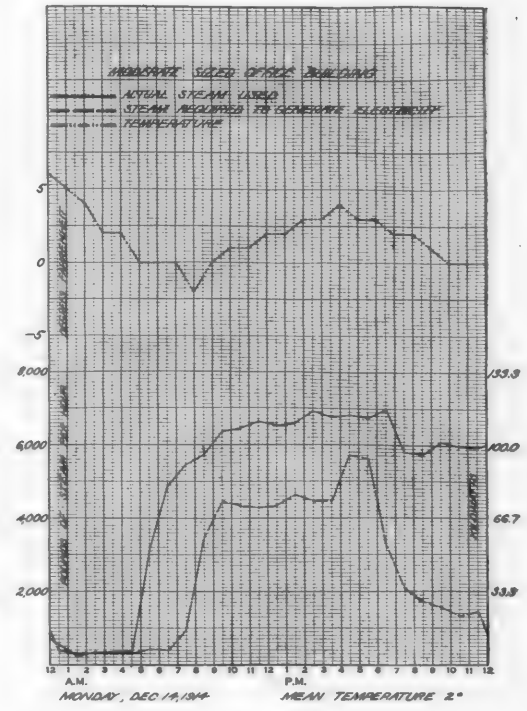


FIG. 6.

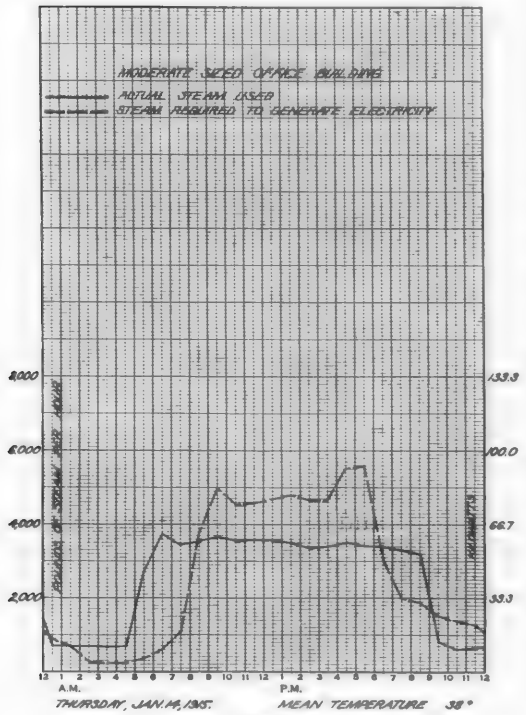


FIG. 7.

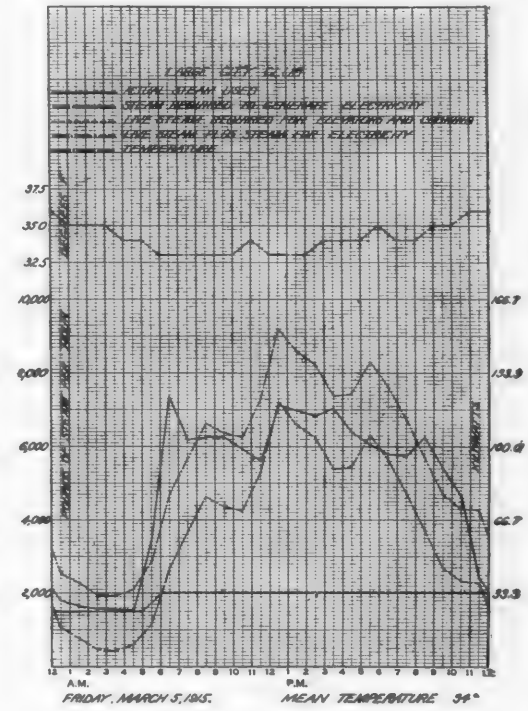


FIG. 8.

LOAD CHARACTERISTICS FOR VARIOUS TYPES OF BUILDINGS.

the electrical requirements. The curve showing the team requirements is used as the basis for figuring the electric curve for the winter load. The space between the steam curve and highest curve will show the amount of exhaust steam which would be necessarily wasted during the summer months if a private plant were in operation.

Fig. 3 shows the conditions of a six-story building in Chicago, which also uses steam for elevator service, but purchases electricity for their lighting and general power. In this figure 3, the electric curve is super-imposed on the summer steam requirements in the same manner as in Fig. 1.

Fig. 4 shows the steam and electric curve during a very cold winter day in a large office building, which is exposed on all sides. This curve shows that in exceptionally cold weather the steam requirements for heating reach very nearly to the steam requirements for electricity throughout the day.

Fig. 5 shows the conditions in the same building on a typical day during moderate winter weather. This curve shows quite a change in the relation between the electric and steam loads and is also on a day which might be considered an average during the winter season. The summer load curve of this building is not given, as there is practically no steam used in the summer time.

Figs. 6 and 7 show the conditions in a moderate sized office building located on the corner and practically exposed on all sides. Fig. 6 shows the conditions in extreme cold weather, while Fig. 7 shows a typical winter day. In this building, also, the steam required in the summer time is practically negligible.

Fig. 8 shows the conditions in a large city club which uses electricity for lighting and power throughout the building, but steam for heating and cooking and ice machinery. This curve represents the conditions on a typical winter day. In order to get the requirements, the electric curve is super-imposed on the summer steam load curve which shows the summer live steam requirements.

These curves have been made up by the method described above, as used by the heat committee of the National Electric Light Association, and most of them are plotted from printometers and compared with the steam load shown by a curve drawing St. John steam-meter. In Fig. 8, however, the steam readings are based on the readings of a Venturimeter. In Figs. 2, 6 and 7 the electrical curves are based on hourly watt-meter readings throughout the 24 hours.

WHAT THE CURVES REPRESENT.

These curves represent the simultaneous values on typical winter days. In order to get an exact relation between heat and electrical road, it would be necessary to integrate the total electrical and steam requirements for each day and also integrate the simultaneous steam requirements. If this were carried through the entire winter season, it would give us the exact relation for any particular building. While such information requires a considerable amount of labor, it would undoubtedly be interesting information and lend valuable assitance in the problem of analyzing isolated plant conditions.

A general idea of the result can, however, be obtained by taking the average of several typical curves during winter conditions and assuming that as the average condition in the five months during which winter weather can be expected, viz., from November to March, inclusive. It is recognized that a large amount of information and data must be had in order to give a comprehensive view of this somewhat intricate problem. These curves are submitted, therefore, not as conclusive but simply as additional evidence on this subject.

It has been found by experience in Chicago that the annual bills for steam heating in large buildings are from one-fourth to one-third the annual cost of operating and maintaining an independent isolated plant. Accordingly a large percentage of saving in the cost of steam heating would be a relatively small factor in the total cost of maintaining and operating a plant. For example, if 60% of the steam required for heating a building could be utilized in operating dynamos, the saving as compared with the total cost of heat and electricity would be not over 20%.

The curves given herewith are taken from buildings located in the city of

Chicago, and in many of the cities of this country the extreme low temperatures herein shown would not be experienced. It is evident that this is a subject on which it is unsafe to make dogmatic assertions; however, enough has been shown to prove that the central-station man, on the one hand, should recognize that the use of exhaust steam for heating constitutes an important economy in the operation of isolated plants, but, on the other hand, the plan operator should recognize that there are many factors tending to modify the extent of this saving, and therefore it will be well to be conservative in making up estimates of cost based on the theoretical saving to be obtained.

ANALYSIS OF HEATING AND POWER COSTS.

Next in order is to take up the problem of making a thorough analysis of heating and power plant costs in any given building.

The use of central-station service for the small consumer is almost a foregone conclusion. In large buildings and factories the use of isolated plant service was formerly the universal rule. The rapid reduction of central-station rates for electricity for the use of the large consumers and a more thorough appreciation on the part of the public of the many advantages of central-station service have conspired to bring about a great change of sentiment among building owners in the last few years. Some of the largest metropolitan buildings are now buying both electric and heating service from the central-station companies, and in every large enterprise which is projected the question of the advisability of manufacturing the electrical service by a private plant is a much mooted subject.

Every owner wishes to figure out, if possible for himself, the solution of the problem, and in order to make a satisfactory estimate it is necessary to make a very careful and intelligent analysis of the operating conditions of the particular building to be considered. The first step in this analysis is to form an estimate of the annual requirements of the building, for light, power and heat; in other words, to determine the load curves. These estimates should be made by first making a complete plan and schedule of the light and power required, and the probable consumption of electricity in every section of the building. After this estimate is made up very carefully, it should be checked with the consumption of electricity in a number of similar buildings, and if the estimate proves to be radically different from the average result found in other buildings the figures should be carefully looked over, as they probably contain some error.

It has been found in collecting data from various large city buildings that there is quite a strong similarity in the electrical requirements of buildings in the same business and this material forms a very useful guide in making up estimates. In like manner the steam consumption for heating and miscellaneous steam requirements should be carefully estimated and these estimates also checked with the known results in similar buildings. These estimates on steam and electrical requirements form the basis of the comparative estimate as to the cost of operation, whether from central station or from a private plant.

By applying the central-station schedules to the estimated requirements, both for steam and electricity, the cost of steam and electricity is very easily computed. Where steam service is not available the cost of operating an independent steam-heating plant can be figured and then added to the cost of the electrical service, based on the schedules of the local company. To these figures should be added the wages of a few men who would be required to oversee the operation of the elevators and other power and to look after the lighting system. Having arrived at the total cost of the service on the central station basis, it will next be necessary to figure the cost of isolated plant operation, and these figures should be based on the figures of similar plants already installed.

Next month the authors will continue the discussion of operating costs and will give hints on presenting the claims of central station service to prospective patrons.

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A. S. ARMAGNAC.....*President*
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A. S. ARMAGNAC, Editor
GUSTAVE PETERSEN, Business Manager

European Representative:
W. G. HOLLINWORTH, 304 High Holborn
London, W. C.

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THE first formal report of the Chicago Commission on Ventilation, which has just been published, is a document of unusual interest. It covers the entire work that has been carried on by the commission since its inception in 1910, including the tests at the Chicago Normal College, tests in different classes of picture theatres, tests in street and elevated cars and tests with an experimental cabinet. In addition, the report contains the full set of "resolutions," which are the form in which the commission's findings and opinions have been set forth from time to time as the investigation proceeded. These, by the way, are silent on the subject of the recirculation of air.

It is no reflection on the commission's work to say that its results have been largely negative, as far as any basic discoveries are concerned, because such has been the uniform experience of those who have recently been engaged in studying indoor air conditions. The fact is that we seem to have reached an impasse regarding the ultimate definition of "fresh" air, but, far from completing its work, the commission announces that the cabinet tests, for instance, have been only of a preliminary nature, to enable the commission to determine the best method of conducting them, and also to determine the best apparatus required to maintain the desired atmospheric conditions. Also the description of the commission's latest installation in the Chicago Normal College, designed to separate the heating from the ventilating, and providing for the heating of the room through the warming of the floor, is sufficiently novel to bring forth valuable data.

The commission has contributed much to the knowledge of the art by defining in concise terms the present status of applied ventilation, as well as the correct theories, in accordance with present knowledge of the subject. Incidentally, the report illustrates the accomplishments that are possible, even with a limited appropriation, when a determined band of workers get together. In this respect the report constitutes an impressive argument in favor of such work on the part of engineering societies.

WE TAKE pleasure in announcing an important new book, entitled "District Heating," by S. Morgan Bushnell and Fred B. Orr. This work comprises the articles on the same subject that have appeared recently in our columns and contains, in addition, an unusual quantity of operating and other data, drawn from the authors' extensive experience in central station heating work. "District Heating" is easily the most exhaustive treatise on this subject that has made its appearance and is a volume worthy of the commanding position which the district heating industry is assuming in many sections.

NATIONAL DISTRICT HEATING ASSOCIATION

Programme for Seventh Annual Convention

Following is the detailed programme of the seventh annual convention of the National District Heating Association, which will be held at the Hotel Sherman, Chicago, Ill., June 1, 2 and 3, 1915. The sessions will be held in the Grey Room and the exhibit, which is always an important feature of the convention, will be in the Louis VI Room:

FIRST SESSION, TUESDAY, JUNE 1, 10:30 A. M.

Welcome Address.
Response.
President's Address.
Report of Secretary-Treasurer.
Report of Executive Committee.
Election of Members.
Appointment of Nominating Committee.
Report of Station Record Committee—A. P. Biggs, Edison Illuminating Co., Detroit, Mich., Chairman.

SECOND SESSION, TUESDAY, JUNE 1, 2:30 P. M.

Paper—"Commercial End of the Heating Business," C. F. Oehlman, Denver Gas & Electric Co., Denver, Colo.
Address—Walter A. Shaw, member Public Utilities Commission of Illinois.
Report of Nominating Committee.

THIRD SESSION, WEDNESDAY, JUNE 2, 9:30 A. M.

Report of Committee on Underground Construction, H. A. Woodworth, Merchants Heat & Light Co., Indianapolis, Ind., Chairman.
Paper—"Operating Experience with Bleeder Type Turbines," F. W. Lass, Chief Eng. Iowa Ry. & Light Co., Cedar Rapids, Iowa.
Paper—E. F. Tweedy, New York Edison Co., New York City.
Election of Officers.

FOURTH SESSION, WEDNESDAY, JUNE 2, 2:30 P. M.

Report of Public Policy Committee—D. L. Gaskill, Greenville, O., Chairman.
Address—J. F. Gilchrist, Vice-President Commonwealth Edison Co., Chicago.
Report of Educational Committee—D. S. Boyden, Edison Illuminating Co., Boston, Mass., Chairman.

FIFTH SESSION, THURSDAY, JUNE 3, 9:30 A. M.

Paper—"The Hot Water Heating System at the Grand Central Terminal," W. G. Carlton, engineer, New York City.
Report of Station Operating Committee—B. T. Gifford, American Public Utilities Co., Grand Rapids, Mich., Chairman.

SIXTH SESSION, THURSDAY, JUNE 3, 2:30 P. M.

Paper—"A Pressure Study of a Steam Distribution System," C. C. Wilcox, Eng. Hodenpyl Hardy Co., Jackson, Mich.
Paper—"Exhaust Steam vs. Live Steam for Heating," Geo. W. Martin, New York Service Co., New York City.

CONVENTION COMMITTEES.

Finance, H. C. Kimbrough, F. F. Vater and Albert K. Root.
Entertainment—Harold Almert, Fred B. Orr, L. S. Shaw, Oliver H. Hogue, George H. Jones, John G. Learned, J. L. Hecht, M. S. Hart, Leslie B. Fiske.
Local Plant Visiting—J. T. Kelly, S. S. Gregory, Frank A. Vath, H. C. Heaton, C. W. Pen Del.

ENTERTAINMENT.

Following are the principal entertainment features:
Tuesday afternoon: Ladies' musical and card party at Hotel Sherman.
Tuesday evening: Theater party for all.
Wednesday morning: Shopping excursions for the ladies.
Wednesday afternoon: Automobile ride to South Shore Country Club, through Washington and Jackson Parks, with tea at the South Shore Country Club at 4:30 to 5 o'clock.
Wednesday evening: Banquet. Entertainment, dancing.
Thursday morning: Shopping tours for the ladies.
Thursday afternoon: Automobile ride along Lake Shore Drive to Mission Tea Room.

THE CONSULTING ENGINEER

The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

44—Cooling Coils for Lowering Temperature of Condensation.

QUESTION: How large a cooling coil will be necessary for 5,000 sq. ft. of radiation operating under 5 lbs. steam initial, or 227° F.?

ANSWER: Cooling coils are more or less guessed at and as long as there is one between the trap and the sewer, it is often passed as O. K. by the authorities. Under higher pressures of steam, when the trap discharges, there is always a percentage of water re-evaporated into steam, due to the high temperature of the condensation and the reduction of the pressure to atmosphere so that the water will become 212° F.

The cooling coil should be between the trap discharge and the sewer and it is policy to seal the outlets so that the coil will always be full of water unless it is desirous to drain it to prevent freezing when it is in a space below 32° F.

If we assume 3 lbs. water per square foot of radiation, there will be 15,000 lbs. per hour. The water may possibly be at a temperature of 220° F. and a certain amount will vaporize into steam until the water becomes 212° F.—and atmosphere pressure.

We will assume the surrounding air 50° F. in extreme weather or whatever it may be in any individual case. The higher the temperature, the more radiation required. The transmission will be assumed 1.8 B. T. U. per square foot, per hour, per degree difference in temperature between surrounding air and water. The condensation should be reduced to 180° F. at least, but the coil is seldom of sufficient size especially if the job is large. The average temperature of the heating surface will be about

$(180+220) \div 2 = 400 \div 2 = 200°$ F.

so the B. T. U. per square foot will be about

$1.8 \times (200 - 60) = 252$ B. T. U. per hour.

The heat of the radiation is

$220 - 180 = 40 \times 15{,}000 = 600{,}000$ B. T. U. per hour.

$600{,}000 \div 252 = 2{,}400$ sq. ft. surface required.

It is readily seen that there is a lot of heat in this water and especially if the water is cooled to any extent, a job like the above would be more likely to have a coil of about 10% of this in practice. If the water goes to the sewer at 212° F. all right; if not, it is figured that a little steam will not be noticed. If the pressure is released, the evaporation of the condensation will quickly bring the temperature to atmosphere. Any other conditions may be assumed and the size of coil figured in the manner indicated.

It is always policy to utilize this heat in some manner and the use of very low pressures in heating would entail greater economy if provision cannot be made to utilize the heat from the cooling coil to advantage.

45—Significance of Different Pressure Terms.

QUESTION: Will you kindly inform me as to the meaning of the expressions: (a) Static pressure; (b) dynamic pressure; (c) total pressure; (d) resistance? Also how the static, dynamic and total pressures are measured, how resistance is measured, and what is meant when it is stated that a fan discharges a certain volume of air against a certain pressure? Is static, dynamic or total pressure intended?

ANSWER: Static pressure refers to the pressure when there is no movement of the fluid. It may refer to the total head available for all purposes. Dynamic pressure refers probably to the quantity known as velocity head or the portion of the pressure changed into velocity. Total pressure means the sum of all the pressures and will always be equal to the head when there is no movement. The total pressure may be static. Resistance is the total head minus the velocity head; also the total head minus the velocity head is the resistance.

A fan discharges a certain amount of air against a certain pressure which equals the velocity head plus the resistance. The total pressure is maximum when there is only a slight opening and small discharge and the resistance is maximum. As the discharge is opened, the volume increases with the velocity head and the resistance goes down. The relation between the pressure at the fan discharge, the area of opening and volume is

found in the characteristic curve for each machine. When the opening is entirely closed, the pressure depends on velocity of blades, speed, etc., and as a rule, the fan takes practically no power, but will show a pressure. As the opening is increased, the air flows, the fan takes power and the pressure on the discharge is reduced, part being used for velocity head and part for friction head or the resistance to flow at the velocity due to area and length of pipe.

This is an incomplete explanation, but will readily be understood if the characteristic curves of any fan are obtained from the manufacturer giving relation between speed, pressure, volume, etc.

The curves are analogous and follow somewhat the same laws as the characteristic curves for dynamos when plotted between volts, amperes, watts, and speed, and centrifugal pumps handling water when the curves are plotted between head, volume, horsepower, etc.

LEGAL DECISIONS

Breach of Contract for Installing Steam-Heating Apparatus—Damages Recoverable.

The R. C. Bartley Company contracted with one Lee to put a heating apparatus in his house, reserving title until he had paid for it. He paid a portion of the purchase price, but refused to pay the balance, and when suit was brought claimed damages. The trial judge decided the facts in favor of the plaintiff, and awarded judgment for the balance of the purchase price. The defendant appealed. The only question presented by the appeal was whether it was proper to allow the Bartley Company to recover the balance of the purchase price or whether they should have been restricted to a recovery of the damages for breach of an executory contract of sale. The defendant's theory was that as the title did not pass, although the heating apparatus was in his house, the only remedy of the plaintiff was for breach of an executory contract. Whether this was to be regarded as a working contract or a contract of sale strictly so called was held to be of no importance. Assuming in the defendant's favor, that it was a contract of sale, the law is settled adversely to his contention. No satisfactory solution of the rights of the parties in such a transaction can be found without observing that the essential character of the transaction is the same as that of an absolute sale with a mortgage back. The plaintiff, therefore, could maintain an action for the purchase price. Judgment for the plaintiff was affirmed.—R. C. Bartley Co. vs. Lee, New Jersey Supreme Court, 93 Atl., 78.

Contract for Installing Heating Plant—Claim for Extras.

Action was brought on a contract for installing a steam-heating plant in a church. The plaintiff claimed that the contract did not require him to cover certain pipes in the basement with asbestos felt, but that he did cover them in pursuance of an order of and an agreement with the architect, and he claimed compensation therefor as an extra. There was no express language in the contract which obliged the plaintiff to cover the pipes, but the defendant argued that if the contract did not in express words require the plaintiff to cover the pipes, his guaranty that the system installed should have the capacity to heat the church to 70° F. when the outside temperature was 10° below zero, would require them to be covered. It was insisted by the defendant that unless the pipes were covered this guaranty could not be complied with. The contention of the plaintiff was directly opposed to this. This, it was held, raised a disputed question of fact, which was properly submitted to the jury, who found for the plaintiff.

It was urged by the defendant that if the covering of the pipes were an extra, the plaintiff could not recover because of section 5 of the general specifications, which provided that no claim for extra work should be considered unless the price for the same should have been agreed upon in writing between the owner, contractor and architects, prior to the commencement of the same. It was conceded by the plaintiff that this provision was not complied with, but it was shown that the architect ordered the work to be done, and arranged with him orally to do it. It was further contended by the defendant that the architect's decision as to whether the contract included the covering of the pipes was final under the eighth section of the general specifications which provided that, in case of dispute as to the meaning of the drawings or specifications, the architects' decision thereon should be final and binding on all parties. The plaintiff answered that these provisions were included in the general specifications, which were never delivered to him, and of which he had no knowledge; that his bid was made and the contract was based upon the "special heating specifications" only. This question was held properly submitted to the jury with

the instruction that if they found that the general specifications were delivered to the plaintiff prior to the making of the contract the plaintiff could not recover. It was also held that testimony that other extras arranged for orally by the contractor was properly admitted for the purpose of showing a waiver of that portion of the contract which provided that all claims for extras should be made in writing within ten days from the beginning of the work. Judgment for the plaintiff was affirmed.—Wenzel vs. Kieruj, Michigan Supreme Court, 151 N. W., 641.

CORRESPONDENCE

Test of Economy and Efficiency of Automatic Temperature Regulation.

EDITOR HEATING AND VENTILATING MAGAZINE:

The article on reporting the test of economy and efficiency of automatic temperature regulation in office buildings by F. A. Boos, which appeared in your April issue, contains some statements which are not entirely clear to me.

It states that the radiator tested was supplied with steam by an overhead distribution single pipe air line vacuum steam system. Further in the article it states that the graduated type of thermostat was used during a portion of the test. The writer fails to understand how it was possible to throttle the steam supply to a radiator connected with such a system without causing water logging of the radiator and thereby its failure to heat properly. Evidently the system installed in the building is not the same as described, otherwise, the writer is at a loss to understand how the results described could be obtained.

The writer cannot understand what line of deduction makes possible the statement that 25 per cent. less radiation can be used with automatic temperature than in the case where no temperature control is provided. The room in which the test was made apparently has cubic contents of 1,920 cu. ft. exposed net wall of 77 sq. ft. and exposed glass area of 50 sq. ft. This room will require 26 sq. ft. of radiation by Prof. Woodbridge's rule, 32 sq. ft. of radiation by Mills' rule and 22½ sq. ft. of radiation by Baldwin's rule, to heat same to 70° F. when the outside temperature is 11° F. The radiator provided contains 45 sq. ft., which accounts for the fact that the radiator was in use but about 8 per cent. of the time. As the minimum temperature in Kansas City, as stated by the United States Weather Bureau, is 20° below zero, it can be readily understood why the additional radiation was installed, and there is no doubt that a considerable saving of fuel is possible by the temperature regulation. However, should the outside temperature be 20° below zero the radiator would then be turned on all the time, even were temperature control provided. And as the building must be heated to 70° under all conditions of outside temperature liable to occur, the same amount of radiation would be necessary with or without temperature control.

The article headed "Operating Cost of Electric Heating Devices" which also appears in this issue, states that 100 per cent. efficiency is possible with electric heating. The writer must taken exception to this in that there must be some loss in the wire which supplies current to the radiator. The heat generated in this wire will not be available in the apartment where the radiator is located and the writer would consider that 90 to 95 per cent. efficiency would be the maximum possible with electric heating.

In figuring the relative cost of coal and electric current for heating purposes, it is stated that electricity at 56 cents per kilowatt hour is the fuel equivalent to coal in the State of Washington. This is evidently a typographical error, as a calculation on the basis stated in the article shows that the cost of electricity should be 56/100 cent per kilowatt hour as the fuel equivalent for coal.

M. S. COOLEY.

Washington, D. C.

REPLY BY F. A. DE BOOS.

Your correspondent is entirely correct in his assumption that the overhead distribution single pipe air line vacuum system would cause water logging of the radiator when the intermediate thermostat is used. However, we only used the intermediate instrument for one day and while there was considerable hammering and pounding of the radiator in consequence of the intermediate control we were not particularly concerned with the temporary inconvenience. Of course, intermediate thermostats should not be used on an air line vacuum steam system, but as we desired to show the difference in the control of the two types of instruments we substituted the intermediate thermostat temporarily as explained above.

The statement that 25% less radia-

tion would, perhaps, be needed with automatic temperature control was based on the assumption that in planning the average heating plant the theoretical amount of radiation is determined from one of the various standard rules, and the general practice is then to add to this amount. With a reliable system of temperature control, accurately gauging the heat for each room of the entire building, such practice would not be necessary. The winter temperature in Kansas City very rarely goes much below zero, and in general heating plans are figured on a basis of zero to ten below.

Of course, when the entire capacity of the heating plant is required to meet the outside weather conditions, temperature control would effect the minimum saving. But it is this fact that the heating plant must be designed for the severer weather conditions that affords the temperature regulation opportunity to make such a large fuel saving, as, in general, the heating plant will be operated at only a small fraction of its capacity. With hand control the room soon overheats and windows are generally opened and the radiator left going. The saving in this particular instance is shown clearly by the chart of February 12, where the temperature was raised from an average of approximately 18½° F. to 71° F. and kept at approximately 71° by the operation of the thermostat, and yet the radiator was in use only about 8% of the time.

Relation of the Architect to the Engineer.

EDITOR HEATING AND VENTILATING MAGAZINE:

Referring to the article on "The Relation of the Architect and the Engineer," in your March issue, I would say that I am intensely interested in this subject which was very well treated by Mr. Kimball.

There is in vogue in some cities in the States a plan whereby a number of architects submit all their work to one office of mechanical engineers and a set scale is made in regard to rates. Could you inform me of the details of this plan, and also some general data regarding the rates charged by engineers and whether the architect or owner pays?

E. H. JOHNSON.

Camrose, Alberta.

REPLY BY D. D. KIMBALL.

I have never heard of any such arrangement as that referred to by your correspondent. Certainly no such system exists in this city, nor in Boston, Philadelphia, Washington, Buffalo, Pittsburgh, Chicago, Cleveland, Cincinnati or St. Louis, nor so far as I know elsewhere. Among the best engineers I believe the practice prevails of establishing a rate of 6% in localities where architects are customarily paid 6%, and 5% where the architects are customarily paid 5%, but a special concession is usually made to the architect where he is obliged to assume the entire cost of engineering services, this concession usually being equal to a 30% reduction in rate. Where the owner reimburses the architect for the cost of engineering services, of half or more thereof, the full rate is customarily charged by the engineer.

Variation of Temperature at Different Room Levels in Furnace Testing.

Editor HEATING AND VENTILATING MAGAZINE.

What variation in temperature for each foot in height, from floor line to ceiling, is allowed when testing out a furnace heating apparatus? The writer has been informed that, taking 5 ft. 6 in. above the floor line as the breathing line, an allowance of 1° per foot difference in temperature, below or above the breathing line is considered a reasonable variation in the temperature of the room being tested, it being understood that there should not be a difference of more than 2° at the same level in the room.

H. D. F.

Greenwood, S. C., March, 1915.

REPLY BY ROY L. LYND.

I do not know that I have ever heard of engineers in this country going into very great refinements on the question of temperature difference between the floor and ceiling of a room. The German engineers, however, do consider this point in their designs, and I quote from "Formulas and Tables for Heating," by J. H. Kinealy, as to their methods of treating the problem:

"H must be calculated for each wall and each cooling surface, floor or ceiling, of a room, and the sum of these quantities is the total heat loss per hour for that room. The different values of t_0 to be used are given in Table II. For the walls, windows and other vertical surfaces of a room whose height from floor to ceiling is not over 10 or 12 ft. the value of t_1 used may be taken from Table I. But where the height of the room is greater than 10 or 12 ft. the temperature of the warm air is greater near the ceiling than near the floor, and the mean temperature of the air must be taken as t_1. Reitschel calculates the temperature, t', of the air at the ceiling of a room by the formula

$$t' = t + 0.03(h - 10)t,$$

where t is the temperature at a distance of 4½ or 5 ft., "head high," from the floor.

"The temperature at the floor is assumed to be t, and the mean temperature, t_1, is given by the equation

$$t_1 = \frac{t'+t}{2} = t + 0.015(h-10)t$$

Reitschel says, however, that t' should not be assumed as greater than about 1.3 t, and therefore it follows that t_1 should not be assumed as greater than 1.15 t.

"When determining the loss of heat from a warm room through a ceiling, Reitschel takes t_1 as equal to t', which he calculates by the equation given above; and when determining the loss of heat from a warm room through a floor Reitschel takes t_1 as equal to t, the temperature 'head high' above the floor.

"Neither Klinger nor Recknagel follows the method adopted by Reitschel of determining the mean temperature of the air in contact with the cooling wall and using it in calculating the heat loss; but they use the temperature that is to be maintained in the room, measured about 5 ft. above the floor, when calculating the heat losses, and increase these losses by an amount which depends upon the height of the room as shown by the following paragraph.

ADDITIONS TO THE CALCULATED HEAT LOSSES.

"The German engineers usually make certain additions to the heat losses determined by the method shown above, which depend upon unusual exposure or upon interruption in the heating.

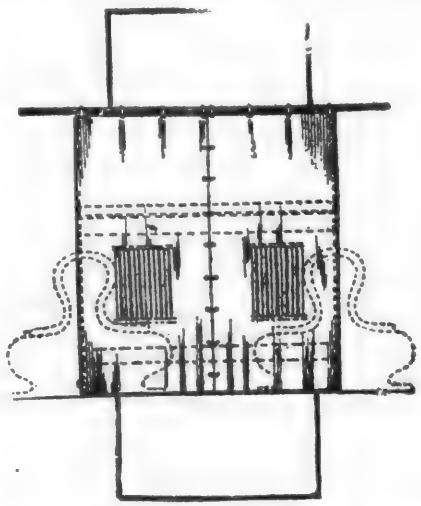
"The increases recommended by Recknagel are: 25% for surfaces having a northern, northeastern or northwestern exposure; 20 to 30% for surfaces exposed to winds; 10% of the total heat losses for rooms more than 13 ft. from floor to ceiling; 20% of the total heat losses for rooms in which the heating is interrupted daily.

"The increases recommended by Klinger are, in general: 20% for corner rooms and 10% for other rooms. For more exact work: 10% for surfaces having a northern, eastern, western, northeastern or northwestern exposure; 5% for corner rooms; 3% for rooms from 12 to 14½ ft. from floor to ceiling; 6½% for rooms from 14½ to 18 ft. from floor to ceiling; 10% for rooms more than 18 ft. from floor to ceiling; 10% when the heating is continued during the day only and the building is closed up during the night; 30% when the heating is continued during the day only and the building is open during the night; 50% when the building remains for long periods without heat.

"Reitschel recommends the following increases on account of exposure: 10% for surfaces having a northern, eastern, northeastern or northwestern exposure; and 10% additional for surfaces that are especially exposed to the wind."

Scheme for Ventilating Sleeping Car Berths.

A Canadian has invented a method for ventilating sleeping car berths through the use of louvred openings in the curtain enclosing the berth. Each curtain is supplied with an opening, making two openings for



CURTAIN FOR SLEEPING CAR BERTH ARRANGED WITH VENTILATING LOUVRES.

each section. These openings are covered with a series of vertical louvres, those of one curtain being arranged to face opposite to those of the other curtain in order that the air may be deflected into the berth irrespective of the direction of travel of the coach.

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

DUST REMOVAL—

State Laws on Removal of Dust. H. Cole Estep. Analysis of the legislation in every state. Ills. 7,000 w. Ir Trd Rev—Feb. 25, 1915. 20c.

RADIATION—

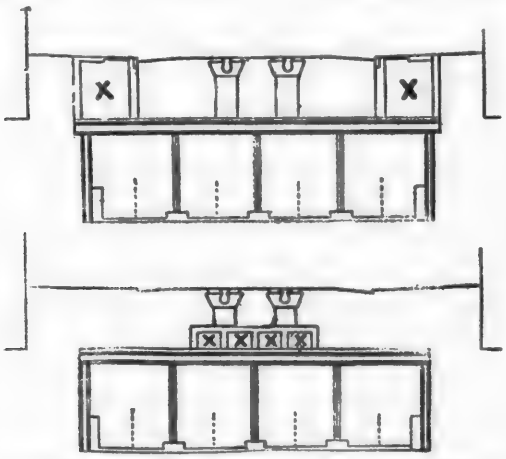
Modified System for Estimating Radiation. Carleton F. Tweed. Gives practical working rules with tables for using the common heat unit method. 4,500 w. Prac Engr, Chicago—Feb. 15, 1915. 20c.

Proposed Rules in New York State for Removal of Dust, Fumes and Gases.

Rules relating to the removal of dust, gases and fumes, proposed by the Industrial Board of the New York State Department of Labor, were the subject of public hearings held at Syracuse, April 27, and at the office of the Industrial Board, in New York, April 29. The proposed rules are based on Sections 81, 82 and 86 of the law on this subject. Regarding grinding, polishing or buffing wheels used in the course of manufacture of articles of the baser materials, the rules cover such items as hoods, size of branch pipes, size of main pipes and fan inlets and outlets, suction, arrangement and construction of pipes, clean-out doors, dampers and fire doors, ventilation, belts and plans. Other rules apply to machines creating dust or fumes; and fumes, vapor or gases. A separate rule is drawn to cover lead dust and fumes. Copies of the proposed rules may be had by addressing the secretary of the board, John Williams, 381 Fourth Avenue, New York.

A Method for Overcoming the Use of Sidewalk Gratings in Subway Ventilation.

The agitation over the use of sidewalk gratings as air outlets in the ventilation of the extensions to the New York subway has led to the proposal shown in the accompanying sketch for obviating the use of such gratings. In the upper sketch is shown the system of ventilation now



PRESENT AND PROPOSED METHODS OF VENTILATING NEW YORK'S NEW SUBWAYS.

planned for the new subways on Broadway and elsewhere. The spaces in the upper left and right hand corners (marked X) represent outlets under the sidewalks with gratings, some of which have been already installed. It is contended that the outrushing air through these sidewalk gratings would be particularly unsanitary and objectionable on Broadway, where the sidewalks in front of the large stores and hotels are usually crowded.

The lower sketch shows the ventilation system designed by George Hallet Clark, engineer. With this arrangement, air would be exhausted from the subway through the small ducts (marked X) shown directly above the tunnel and forced out at such open spaces as Union Square, Madison Square, Herald Square, etc. This system of ventilation, it is claimed, would be continuous, while the other plan would be fitful.

An item on another page of this issue notes the action of the Public Service Commission in voting to call in a firm of ventilating experts on the matter.

Separate Contract Law Passed in New Jersey.

The separate contract bill, which was introduced in the New Jersey legislature last January, became a law March 29, 1915, when, after a hearing in the executive chamber, it was signed by Governor Fielder.

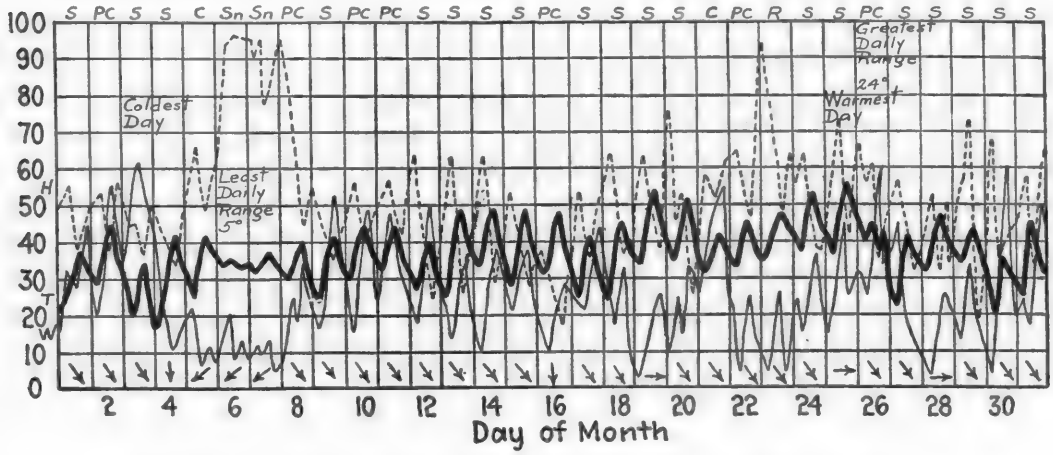
The new law is listed as Chapter 95 of the Laws of 1915 of the State of New Jersey and is as follows:

1. Hereafter in the preparation of plans and specifications for the erection, construction, alteration or repair of any public buildings in this State, whether the same is to be erected, altered or repaired by the State or any political subdivision thereof, when the entire cost of such work will exceed one thousand dollars in amount, it shall be the duty of the architect, engineer or other person preparing such plans and specifications to prepare separate plans and specifications for the plumbing and gas fitting, and all work kindred thereto, and of the steam and hot-water heating and ventilating apparatus, steam power plants and work kindred thereto, and electrical work; and it shall be the further duty of the board or body, person or persons authorized by law to award contracts for the erection, construction, alteration or repair of any such public building, to advertise for, in the manner provided by law, and to receive separate bids for each of said branches of work, and to award contracts for the same to the lowest responsible bidder for each of such branches respectively.

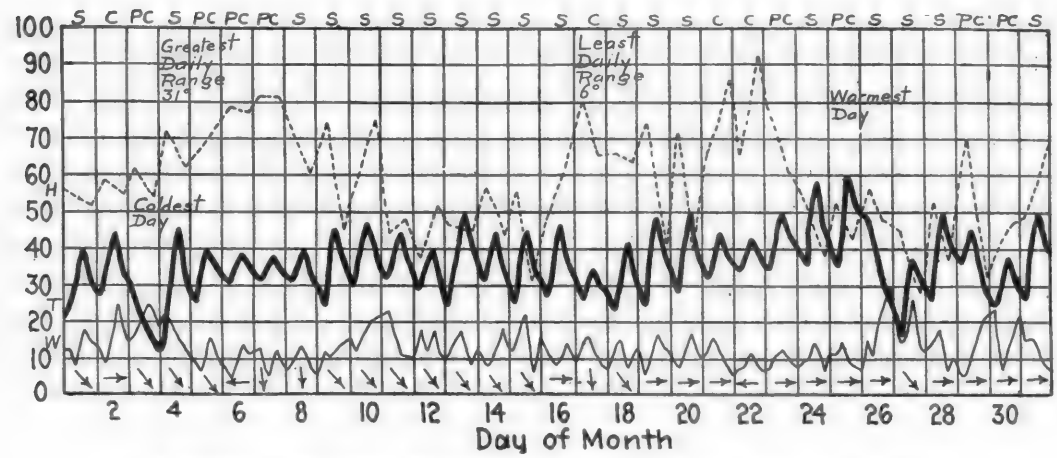
2. All acts or parts of acts inconsistent herewith are hereby repealed, and this act shall take effect immediately.

The Weather for March, 1915.

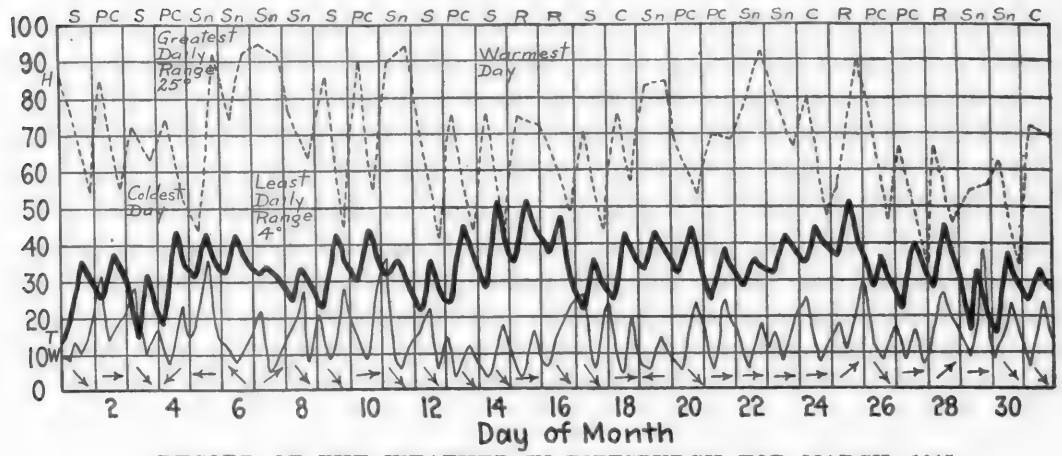
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F	55	60	51	57	61
Date of highest temperature	25	25	14	24	24
Lowest temperature, degrees F	18	13	15	21	28
Date of lowest temperature	3	3	3	29	29
Greatest daily range, degrees F	24	31	25	22	27
Date of greatest daily range	26	4	4	24	24
Least daily range, degrees F	5	6	4	4	4
Date of least daily range	6	17	7	6	6
Mean temp. for month, degrees F	36	36	33	35	38.5
Normal mean temp. for month, deg. F	37.5	35	39.5	34.4	43.5
Total rainfall, inches	1.14	..	1.26	0.6	0.44
Total snowfall, inches	7.7	..	5.8	3.6	2.00
Normal precipitation, this month, in.	4.1	4.08	3.01	2.55	3.43
Total wind movement, miles	16661	9237	9347	7909	8184
Average hourly wind velocity, miles	22.4	12.4	12.6	10.6	11
Prevailing direction of wind	N.W.	N.W.	N.W.	N.W.	N.W.
Number of clear days	19	20	8	11	6
Number of partly cloudy days	7	8	11	8	12
Number of cloudy days	5	3	12	12	13
Number of days on which rain fell	4	..	12	7	10
Number of days on which snow fell	2	..	10	4	3
Snow on ground at end of month	..	..	Trace	..	..



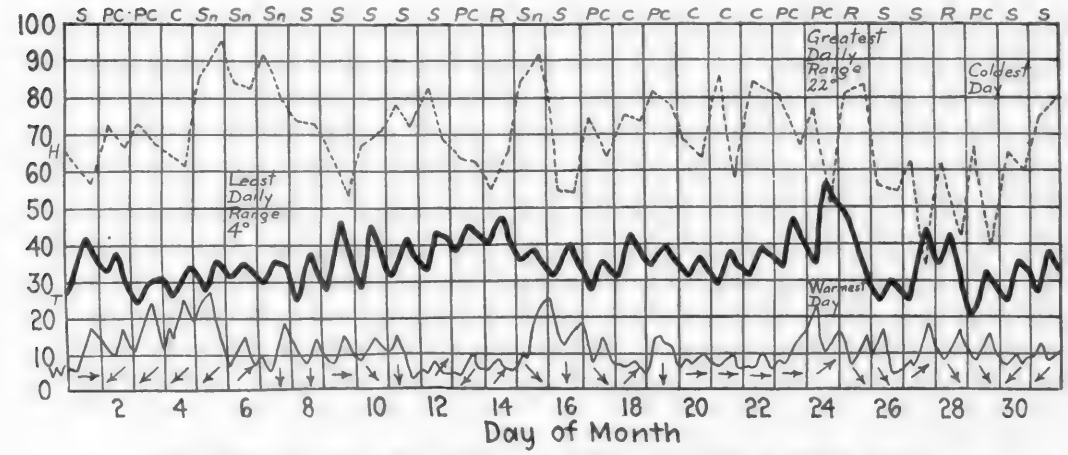
RECORD OF THE WEATHER IN NEW YORK FOR MARCH, 1915.
(Relative Humidity Curve is Plotted from Hourly Observations.)



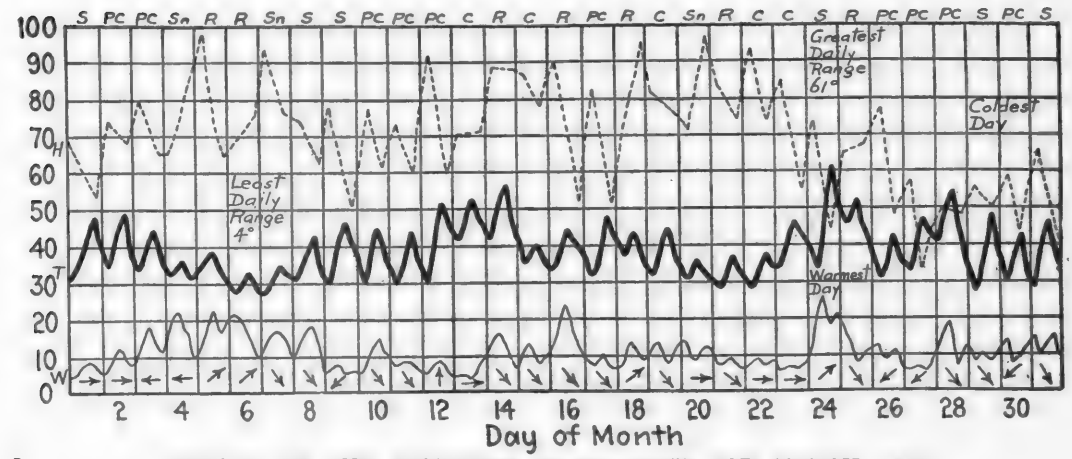
RECORD OF THE WEATHER IN BOSTON FOR MARCH, 1915.



RECORD OF THE WEATHER IN PITTSBURGH FOR MARCH, 1915.



RECORD OF THE WEATHER IN CHICAGO FOR MARCH, 1915.



RECORD OF THE WEATHER IN ST. LOUIS FOR MARCH, 1915.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

United States Government to Publish Mid-Day Humidity Readings.

The United States Weather Bureau, in the past, has only published the temperature and humidity readings morning and evening and the temperature only during noon time, and it has been customary for the daily papers to publish the maximum and minimum temperature and the average relative humidity. This has served, in many cases, to create a wrong impression in the mind of the public regarding the humidity. For instance, with maximum and minimum temperatures of, say, 95° F. and 70° F. a relative humidity of, say, 90%, it would appear that the relative humidity at 95° was 90%, whereas, as a matter of fact, the 90% relative humidity was only during the morning and evening, or, in other words, during the periods of minimum temperature.

Due to the initiative of W. G. R. Braemer, manager of the air conditioning department of Warren Webster & Co., Camden, N. J., announcement is made by Professor C. H. Marvin, chief of the United States Weather Bureau, that "action will be taken looking to the publication of these data (mid-day humidity readings) at the weather bureau stations where found practicable."

In a letter to Professor Marvin, which resulted in the action stated, Mr. Braemer said that the erroneous impressions obtained by the public from the weather bureau reports is a source of much annoyance to all interested in the manufacture of air conditioning apparatus, inasmuch as inquiries are often received from clients to furnish estimates on apparatus to cool air, say, from 95° F. and 90% relative humidity, to 70° F., and, of course, considerable correspondence is involved and many times the prospective client will give up the matter because of the tremendous cost of the apparatus to take care of the condition he specified, which never exists in actual practice.

A New Industrial Commission Bill for New York State.

A bill to create an industrial commission, which will administer all labor laws, including the inspection of workplaces, has been introduced in the New York State legislature. The bill has been reported favorably by the Senate committee on labor and industry. If it is passed, the head of the labor department will be succeeded by an industrial commission consisting of five members appointed by the governor for terms of six years each at salaries of $8,000 each. To advise the industrial commission, an industrial council, equally representative of employers and employees, is provided for. In addition to abolishing the office of commissioner of labor, the bill would do away with the workmen's compensation commission and the industrial board in the Labor Department, which at present has the power, among other things, to make rulings regarding the heating and ventilation of factory buildings. The purpose of the change is to secure greater economy and efficiency through the unified administration of all labor laws. The proposed law has the endorsement of the American Association for Labor Legislation.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

New York Chapter Elects New Officers.

William H. Driscoll was elected president of the New York Chapter at its April meeting, when reports of the officers for the year were also presented. Arthur Ritter was elected vice-president; W. J. Olvany, treasurer; F. K. Davis, secretary, and W. S. Timmis, W. F. Goodnow and Perry West, governors.

The treasurer's report showed a cash balance of $381.45. The receipts for the year were $329.80 and the expenses $202.45. The secretary reported a membership of 75, as compared with 71 at the beginning of the year.

The report of the chapter dinner committee, recommending a $5.00 dinner, was finally adopted after discussion. It will be held May 17 at the Claridge Hotel, Broadway and 44th Street, New York.

On motion of W. M. Mackay, the name of William J. Baldwin was presented for honorary membership in the chapter, and it was voted to recommend such action to the board of governors. It was also voted, on Mr. Mackay's motion, to recommend to the society that a portrait be obtained of its first president, E. P. Bates, of Syracuse, to be hung at the society headquarters, alongside of the portraits of the other past presidents.

The talk on "export engineering," which was to have been given by Rawson Vaile, manager of the export department of the American Blower Company, was put to a later date, owing to the unavoidable absence of Mr. Vaile.

President Timmis reported for the build-

ing code committee, stating that the committee, composed of Messrs. Chapman, Ohmes and Kimball, had met Rudolph P. Miller, of the building code commission, and had presented their recommendations regarding the proposed heating and ventilating ordinances. President Timmis, in resigning the chair, expressed his thanks to the members for their courtesy and co-operation and bespoke the same co-operation for his successor.

Illinois Chapter.

Methods of heating and controlling the temperature of swimming pools and shower baths were presented at the April meeting of the Illinois Chapter by Leo H. Pleins, sanitary engineer for James B. Clow & Sons, of Chicago. Mr. Pleins advocated the closed type heater in preference to the injector method of heating swimming pools.

An appropriation of $50 made to the committee on pipe covering was reappropriated to the committee on air washing. In this connection Dr. Vernon Hill, of the Division of Ventilation of the Chicago Health Department, described the equipment for testing air washers which has been installed in the pent house on the roof of the Chicago City Hall. This experimental plant, he announced, is open to any who desire to visit it. Among those present at the meeting was W. G. Braemer, of Warren Webster & Co., Camden, N. J., who invited the members to visit the company's air conditioning plant and laboratory in Camden.

The May meeting, scheduled for May 10, was in charge of the committee on air washing and marked the close of the season.

Massachusetts Chapter.

Laurence Franklin was the principal speaker at the April meeting of the Massachusetts Chapter which was held at the New City Club, April 13, with Past-President W. G. Snow in the chair. Mr. Franklin showed and explained in detail a number of heating and ventilating plans, made in 1883 by his father, the late Albert B. Franklin, for some of the Boston school buildings. These plans were among the first made by Mr. Franklin and aroused much interest. The speaker was given a vote of thanks at the close of his remarks.

Frank Irving Cooper presented a synopsis of the proposed law now before the Massachusetts legislature, relating to the construction, alteration and maintenance of buildings. This is House Bill No. 1750, and has been reported favorably by the committee to which it was referred. It was voted to invite Frank T. Chapman, of the committee on minimum heating and ventilating standards of the society, to appear before the legislature on behalf of the society to further the passage of the bill. It was also arranged to have Vice-President Eugene R. Stone, Secretary Charles Morrison and Mr. Cooper attend this hearing.

An amendment to the chapter's by-laws was passed changing the date of the annual meeting from October to May, so as to give the newly-elected officers an opportunity to develop their plans for the ensuing year. It was stated that several of the chapter members were arranging to attend the society's summer meeting in San Francisco in September.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Michigan State Association.

The Michigan State Association of Master Steam and Hot Water Fitters elected the following officers at its second annual convention, held in Detroit, April 8: President, William Gourlay, Jr., Detroit; vice-president, William Pulte, Grand Rapids; secretary-treasurer, Otto Wurm, Detroit. Members of executive committee: Charles A. Blaney, Kalamazoo, and C. L. Bigelow, Saginaw. After the meeting was called to order by President Julius A. Ziesse, an address was made by William F. McDonald, of Detroit, who spoke on live problems in the heating trade, such as low bidding, relations of the architect to the engineer and loosely drawn specifications. C. P. Tietze, of Detroit, who also spoke, advocated better janitor service to secure proper operation of heating installations. During the midday recess, an inspection was made of the new building for the Detroit Athletic Club, the heating system for which was installed by the Vinton Plumbing & Heating Co. The trip was in charge of James R. Bolton, president of the Detroit Master Plumbers' Association.

New York City Association.

Following are the new officers of the New York City Association of Master Steam and Hot Water Fitters, elected at its annual meeting, March 23: President, Joseph G. Geoghegan; vice-president, William H. Curtin; treasurer, J. E. Rutzler; secretary, H. B. Gombers. Board of Directors: Joseph G. Geoghegan, William H. Curtin, J. E. Rutzler, Michael J. Callahan and G. F. Steffany.

Detroit (Mich.) Association.

James W. Partlan, the retiring president of the Detroit Association of Master Steam and Hot Water Fitters, was presented with a silver cup as a token of appreciation on the part of his fellow members. The presentation took place March 10 when 25 members surprised him at his home.

Pennsylvania State Association.

The annual convention of the Pennsylvania State Association of Master Steam and Hot Water Fitters is scheduled for Philadelphia, Pa., May 27.

Class Dinner of New York Heating and Ventilating School.

Fifty members and guests of the New York Heating and Ventilating School attended the annual dinner of the class which was held at the Wool Club, New York, April 12. Charles A. Fuller, director of the class, presided, and the office of toastmaster was filled by Frank K. Chew. It was stated that during the past season the school had an enrollment of 39 members. The speakers included Frank T. Chapman, R. L. Pryor, W. J. Olvany, Max M. Peabody, "Jack" Armour, famous for his wit and humor, and Mr. Kraft, of the Westinghouse Electric & Mfg. Co. The dinner arrangements were made by George G. Schmidt, secretary of the school.

New Kingsbury Hot Blast Heater Soon to Be Placed on Market.

Announcement is made that the new Kingsbury hot blast heater, invented by William M. Kingsbury, heating and ventilating engineer for the Board of Education, in Cleveland, Ohio, will be ready for the market about July 1, 1915. This heater, which is made of cast iron, was illustrated and described in THE HEATING AND VENTILATING MAGAZINE for August, 1913. Since that time, it has undergone extensive tests. A company has now been formed to market the heater. A catalogue is in course of preparation which will be issued about June 1.

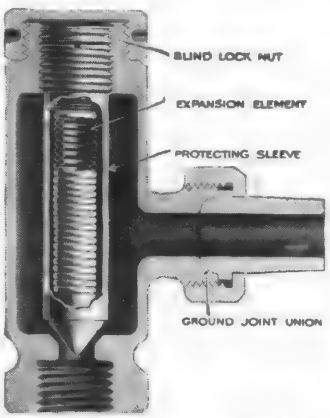
O. L. Remington, general manager, and H. P. McColl, engineer for Wm. McLean & Co., Melbourne, Australia, are now in this country investigating methods, machinery and new developments in the field of heating and ventilation. Messrs. Remington and McColl, who have been stopping at the La Salle Hotel in Chicago, are visiting all of the principal industrial centers in the East before going to England.

NEW DEVICES

The Winn Steam Trap.

The accompanying illustration shows the Winn steam trap, which has been on the European market for many years under the name of the Welo trap and is now being manufactured in the United States. It is for use with vacuum, vapor and modulation systems of heating. The trap is built on the thermostatic principle which makes it positive in its operation.

Some of the features are long expansion element, seamless corrugation, large discharge opening and non-collapsible expansion element.



THE WINN STEAM TRAP.

These features are designed to give large capacity, durability, and efficiency. The trap is self-cleaning and is claimed to be noiseless in operation.

The trap consists of an outer casing made entirely of brass. The valve seat forms an integral part of the casing. The casing has a ground joint union tail piece for attaching it to the heating unit. In this casing a sensitive expansion element is inserted.

The expansion element consists of a seamless corrugated bronze tube, which is filled with an expansion liquid. The valve head is attached to this tube, and when steam comes in contact with it the liquid inside expands and pushes the valve head to its seat. As soon as water collects around the tube the liquid contracts, and the valve opens, permitting the water to pass through freely into the return line. The valve works automatically, thus requiring no attention after being installed. The protecting sleeve guides the valve head to its seat, and protects the corrugated element against scale and dirt.

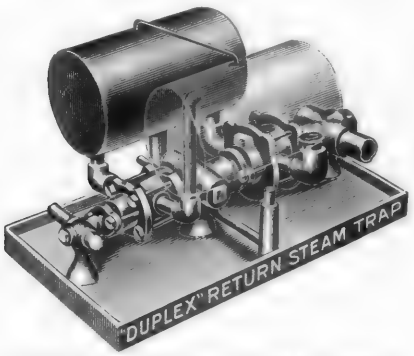
These traps are manufactured and sold by the Detroit Steam Specialty Co., Kerr Building, Detroit, Mich., and are described in detail in the company's "Bulletin A."

New Publications.

EVERREADY PIPE AND ELBOW CHART, by M. W. Pehl, is an ingenious little calculator, made of celluloid, containing full instructions for quickly and accurately laying out and cutting all kinds of elbows, pipe and ventilation work. The chart is accompanied by a 54-page book of instructions and tables for sheet metal workers, boiler makers, etc. Size of instruction book (celluloid chart being contained in pocket at back of book) 4½x6¾ in. Price $1. May be had from the book department of THE HEATING AND VENTILATING MAGAZINE.

Trade Literature.

DUPLEX STEAM TRAP AND BOILER FEEDER is featured in a recent circular of the Duplex Steam Trap Mfg. Co., Detroit, Mich. This machine is stated to be the first ever manufactured that will feed the boiler direct from the main or other sources, discharging a continuous stream of water to the boiler. The

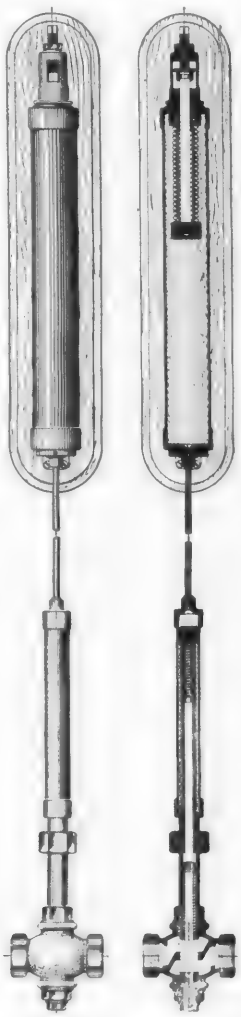


DUPLEX RETURN STEAM TRAP.

water passes through a heater, is heated by exhaust from the engine and put into the boiler at any temperature, thus dispensing with pumps and injectors. By referring to the illustration it will be seen that the trap does not stand still to fill and the same to empty, but when one tank is filling the other is emptying, thus giving the continuous water stream. The apparatus is made without floats, springs, levers or weights.

GOLD'S ELECTRIC THERMOSTATIC CONTROL OF STEAM HEATING as applied to a railway car, is described in a circular of the Gold Car Heating & Lighting Co., to which is added a test of the Gold thermostatic control as compared with the Gold straight steam heating system. In addition to securing a more even temperature with the control system the steam saving ran from 41% to 83%. The company manufactures the Gold temperature regulating system for use in buildings, operated entirely from the lighting circuit.

SARCO TEMPERATURE REGULATORS (Samson Patents), including heat regulating devices of all kinds and Sarco thermostatic controllers, are described in circular matter published by the Sarco Engineering Co., New York. Among the interesting devices shown is the Sarco



SARCO ROOM TEMPERATURE REGULATOR.

room temperature regulator which is especially adapted for office buildings, etc., where a uniform temperature is desired. It does not require electricity or compressed air and has no clockwork or diaphragms. Apart from its operating fluid it is constructed entirely of metal. It is made with valve sizes from ⅜ in. to 4 in. in diameter.

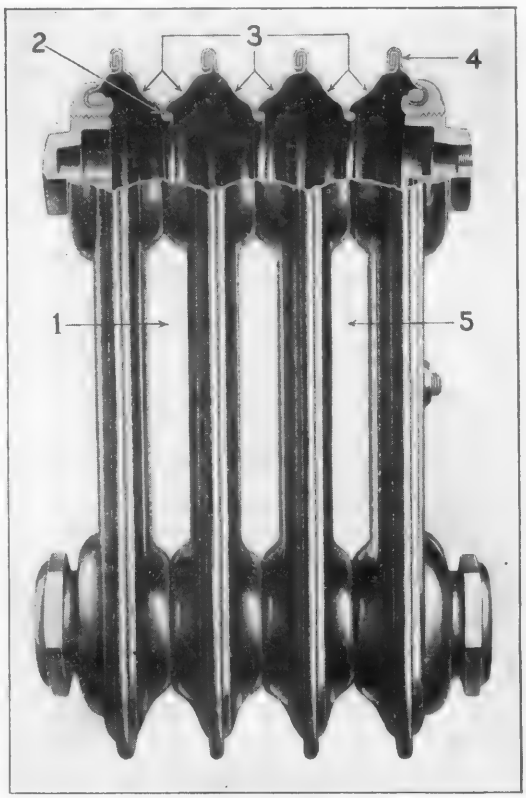
MACK EJECTOR-VENTILATOR, manufactured by the McDonald Bros. Co., Swetland Building, Cleveland, O., is a new device described in recently-issued circular matter. It is described as not only weather-proof, but a real ventilator, doing its work at all times and under all conditions. It has been found that the low and rarely measured velocity of 2½ miles per hour is sufficient to create a suction

MACK EJECTOR-VENTILATOR.

in the Mack ventilator. In operation, the wedge, always pointed into the wind, deflects the current into three separate horizontal ducts, which cover the head. These ducts, decreasing in size toward the discharge ends, compress the current so that it discharges at high velocity. This powerful ejector-discharge generates a continuous partial vacuum inside the head, causing a strong suction in the stack, independent of temperature. With this device it is claimed that down-draft or back pressure of outside air is impossible, while heavy gases and cold air are lifted and discharged. Care is taken to provide freedom of motion and noiseless operation by using an inverted bronze cone-bearing. The Mack ejector-ventilator is made in 14 sizes, with capacities ranging from 4,300 to 374,000 cu. ft. air displacement per hour.

FORD STEAM AND WATER SPECIALTIES, comprising the product of the Thomas P. Ford Co., Inc., 407 Broome St., New York, are featured in a new and attractive catalogue. Among the devices shown and described are improved damper regulators (high and low pressure), compound steam traps, reducing valves (steam, air and water), pump governors and pressure regulators, balanced tank valves, fire line reducing valves, by-pass valves, controlling devices and relief valves. The catalogue refers with pride to the fact that this line has been on the market for 23 years without interruption. Under the heading of "To Get Acquainted," the catalogue contains some timely remarks regarding the general subject of facilities, deliveries and guarantees. Size 5¼x8 in. Pp. 32.

PRESTO SANITARY RADIATORS, for residences, apartments and public buildings, featuring their sanitation, durability and quick uniform heat distribution at low fuel expense, are the subject of a newly-issued catalogue published by the Pressed Metal Radiator Co., Pittsburgh, Pa. This well-known radiator, due to its construction of pressed metal in place of cast-iron, occupies one-fourth less space and weighs one-third the amount of other types. On account of its light weight it can readily be attached to the wall, giving a free, unobstructed floor space. It is also pointed out that the wide space between sections gives ready access to every part and the smooth surfaces may be easily dusted. In rooms



CONSTRUCTION OF THE PRESTO RADIATOR.

likely to become overheated or requiring quick heating up, this type is especially recommended by the manufacturers due to the rapidity with which the radiator heats and cools. The catalogue includes a display of typical buildings in which Presto radiators

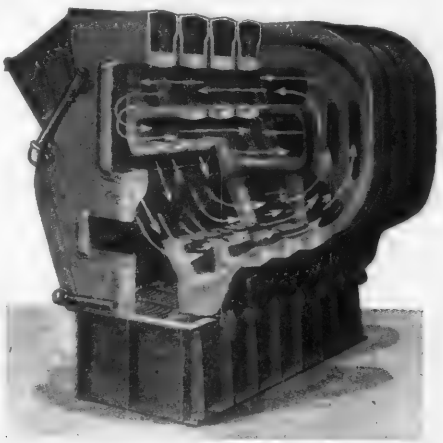
are installed. A broken view of a typical radiator shows its details of construction.

(1) represents the wide air spaces to provide uniform heat distribution; (2) shows the metal-to-metal air-tight inner seam; (3) shows the special anti-corrosive metal of uniform strength and thickness throughout; (4) indicates the double thickness of outer seam, to secure rigidity and durability; while (5) shows the easy cleaning feature, due to the wide spacing of the sections. Views are also presented in the catalogue of the company's plant in West Pittsburgh, including interior views of the press department and expanding department. Size 6 x 9 in. (standard). Pp. 16.

LILLIE'S MULTI-POT BOILER is the title of a refreshing catalogue published by the Multi-Pot Boiler Co., Denver, Colo., which starts off with some "straight jabs" about boiler manufacturers' catalogues, and continues to expound, in a breezy manner, their various shortcomings. Regarding a rating based on a hard coal test, for instance, the opinion of this writer is that it "is about as useful to a soft coal user as a test made on an old cheese." The Multi-Pot steam and water boilers are shown and described and the ratings are given for "fair draft chimneys," "good draft chimneys," and "strong draft chimneys." Size 3½x6 in. (standard). Pp. 12.

LILLIE MULTI-POT WATER BOILER.

PIERCE DOWN DRAFT BOILER, containing the features of the down-draft principle, smoke consumption, magazine feed, self-cleaning surface and adaptability for burning and kind of fuel, is featured in a recent circular published by the Pierce, Butler & Pierce Mfg. Corp., Syracuse, N. Y. The distinguishing feature of this heater is the arrangement of the combustion chamber and the course followed by the fire travel. The draft coming from above the fresh coal, carries the gases down and through the fire, so that the boiler is comparatively smokeless in operation. This boiler is furnished for either steam or hot water heating and is made in a wide range of capacities.

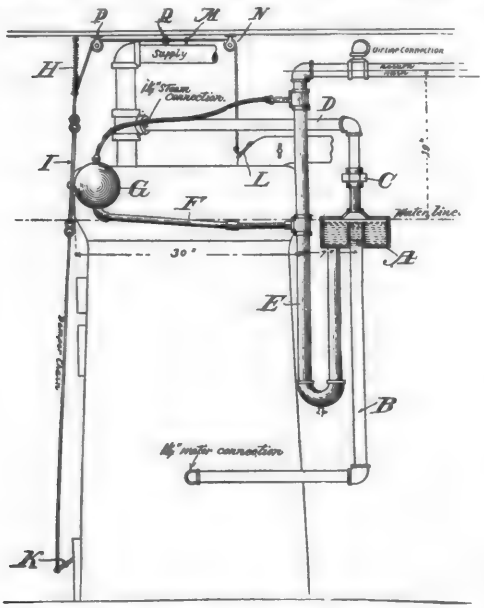


PIERCE DOWN-DRAFT BOILER.

THE STORY OF THE PLUMFOOL WHO CONFESSED, which is being published in serial form by the International Heater Co., Utica, N. Y., contains, in the latest edition, "Pop's Story," which is the third of the series. It is well worth reading.

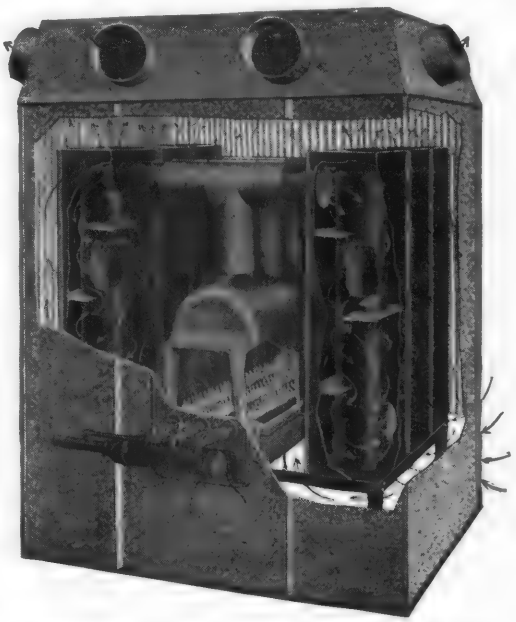
SOME SAVING SENSE ON HEATING AND THE LAST LAUGH are titles of two well-gotten-up circulars, published by the Kelsey Heating Co., Syracuse, N. Y., and explaining how Kelsey heat differs from the usual hot air heat. One of the typical installations shown is of the Kelsey humidifier and water supply tank, as attached to the heater. In the circular on "The Last Laugh," a full set of floor plans are reproduced of a Kelsey heated residence, showing the location of the warm air inlets and foul air exits.

MODERN HEATING FOR THE HOME, devoted to the Hutchison system of vapor heating, described as the most efficient and economical heating system ever devised, is described in a catalogue issued by the Hutchison Vapor Heating Corporation from its new headquarters, the Woodward Building, Washington, D. C. The principal devices of this system consist of the Hutchison vapor valve, Hutchison damper regulator and Hutchison trap-receiver. The interesting feature of the trap-receiver, which comprises a single casting, is that it maintains an even water line in the boiler. It delivers the condensation to the bottom of the boiler, is designed absolutely to prevent water backing in the returns, and acts as an auxiliary safety valve. It is stated that by its use all thermostatic, float and check valves are eliminated and there are no movable parts in the returns from the radiator to the boiler. The operation of the Hutchison damper regulator and trap-receiver may be seen by referring to the accompanying illustration. It will be noted that the trap-receiver is connected from its top with the supply main and from its bottom with the return opening in the boiler. The top of the trap-receiver is placed on a level with the water-line, therefore the water stands in the pipe B on a level with the water in the boiler. The condensation from the return main flows down pipe E around the bend in trap-receiver A where it overflows into pipe B, returning to the boiler. As the vapor pressure rises in the boiler, the water remains in pipe B on the water-line with the boiler, while the water in trap-receiver A is forced downward through the return bend and up pipes E and F into the regulator globe G. The additional weight of water in globe G causes same to lower, closing front damper K and opening check draft L, thereby retarding combustion. As the pressure lowers in the boiler, the water will flow from globe G back through pipes F and E into the trap-receiver and the globe G, being lightened, will rise to its former position by action of spring H. This action continues until the damper regulator automatically adjusts itself to allow only sufficient combustion to supply the demands on the boiler. Complete directions for connecting and adjusting the Hutchinson system are contained in the catalogue. Size 6¼x9¼ in. Pp. 16.



TRAP-RECEIVER AND DAMPER REGULATOR FOR THE HUTCHISON SYSTEM OF VAPOR HEATING.

COLUMBUS GAS FURNACE, for residences, schools, churches, stores, etc., manufactured by the gas furnace department of the Columbus Heating & Ventilating Co., Columbus, O., is a notable type of heater which is illustrated and described in a well gotten up circular, just issued. The manufacturers state this heater has been developed after years of experiment and that due attention has been paid to the economical consumption of fuel as well as to the manner in which the furnace is constructed. It is emphasized that in this heater all the heat comes directly in contact with the radiating surface, evenly divided, producing an intense heat. All joints and seams are spot welded



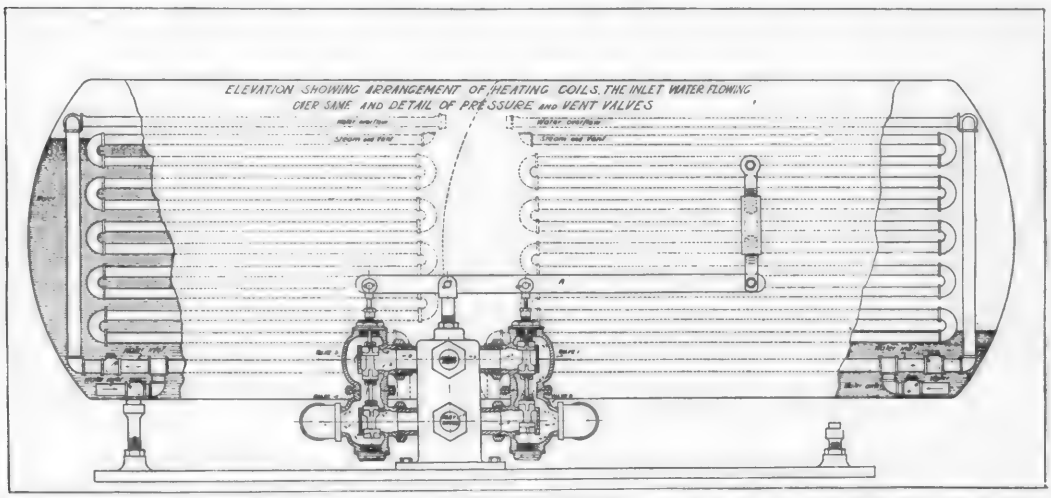
SECTIONAL VIEW OF COLUMBUS GAS FURNACE.

with an electric welder, or double seamed by special machinery to insure tight connections. The construction of the heater makes it necessary that the products of combustion or hot gases must travel the entire circuit of the radiators before reaching the pipe to the chimney. The Columbus gas furnace is made in three sizes, varying from 30 in. deep to 45 in. deep. The other dimensions are the same in all sizes, namely, 48 in. wide and 66 in. high. The company's guarantee, which accompanies the circular, states that when properly installed the Columbus gas furnace "will heat and ventilate the halls, rooms and chambers in which there are register connections with the furnace, to an average temperature of 70° F. in zero weather."

POWER AND HEATING PLANT CONDENSATION UTILITIES, made by the F. C. Farnsworth & Co., Bush Terminal, Brooklyn, N. Y., are presented in a well-designed catalogue. They include the Farnsworth duplex combined boiler feed, feed-water, heater, receiving tank and weighing apparatus, which is described as packless, automatic, of positive action and giving continuous flow; also the Farnsworth positive acting, double seal, water balanced, packless steam trap or blow-off tank, and the Farnsworth positive acting, double seal, water balanced, packless three valve lifting trap and condensation weighter. Elevation and plan views of the heater and receiving tank show in detail the principle on which the apparatus is built. Each compartment of the tank is connected separately with the water or condensation pipes. The water is collected alternately through the receiving check valves, and thence through flexible copper hose connections leading to the bottom of each compartment of the tank. The water is delivered from the bottom of each compartment of the tank alternately, through the hose connections and through the delivery check valves. The receiving and delivery process into each of the compartments alternates as the tank oscillates, reversing the steam and vent valves which are connected to each compartment of the tank by flexible copper hose, and a pipe extends to the top of each compartment to apply the steam pressure directly on top of the water The insertion of a copper coil in each compartment makes the tank also a feed-water heater. Size 6x9 in. (standard). Pp. 20.

KINEALY AIR CONDITIONING APPARATUS, which is now being marketed by the Consolidated Engineering Co., Chicago, Ill., is the subject of a new catalogue devoted to the Kinealy air washer and its accessories. The views show the latest types of this apparatus, including the present construction of the Kinealy self-cleaning mist nozzle and self-cleaning spray head. A full set of dimensions are included for the Type A apparatus. Size 8½x11 in. (standard). Pp. 8.

SIROCCO PRODUCTS, covering generally the entire air-conditioning product of the American Blower Co., Detroit, Mich., is the title of a notable publication of handsome design and unusual attractiveness. It is profusely illustrated with types of the company's apparatus, typical buildings equipped with Sirocco systems and photographic diagrams of heating and ventilating layouts, showing the installation and operation of the various units. The products include fan systems of heating and ventilating, fan systems of cooling and ventilating, drying systems, mechanical draft apparatus, blast equipment, automatic return steam traps and vertical enclosed self-oiling steam engines. Size 8½x11 in. (standard). Pp. 32.


ELEVATION SHOWING ARRANGEMENT OF HEATING COILS. THE INLET WATER FLOWING
OVER SAME AND DETAIL OF PRESSURE and VENT VALVES

FARNSWORTH DUPLEX COMBINED BOILER-FEED, FEED WATER HEATER, RECEIVING TANK AND WEIGHING APPARATUS.

WEBSTER MODULATION SYSTEM OF STEAM HEATING, is the title of a catalogue of remarkable attractiveness, just published by Warren Webster & Co., Camden, N. J. The Webster modulation system is described in detail, and emphasis is laid on the fact that the company's 27 years' experience in low-pressure steam heating and its facilities in organization and manufacturing, combined with the standing the company has attained in this field, are sufficient guarantees of the success of the Webster modulation system. The devices used with this system are taken up in order and the typical layouts shown are carefully drawn so that each part and connection may be easily noted. A large portion of the catalogue is given over to an imposing array of buildings in which the Webster system is installed. Size 8x10 in. Pp. 88.

New Vacuum Heating Catalogue.

An unusually complete and readable catalogue on vacuum and vapor heating equipment, with especial reference to the Reliable heating specialities, has been issued by the Bishop-Babcock-Becker Co., Cleveland, Ohio, and is now ready for distribution.

OWNERSHIP NOTICE.

Statement of the ownership, management, etc., of THE HEATING AND VENTILATING MAGAZINE, published monthly at New York, N. Y., required by the Act of Aug. 24, 1912.

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Heating and Ventilating Magazine Co., 1123 Broadway, New York.
A. S. Armagnac, 1123 Broadway, New York.
Gustave Petersen, 1123 Broadway, New York.
Known bondholders, mortgagees and other security holders holding 1% or more of total amount of bonds, mortgages, or other securities:
None.

(Signed) A. S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 11th day of March, 1915.
(Seal) (Signed) A. L. SCANTLEBURY, No. 64.
Notary Public, Kings County, Certificate filed in New York County.
(*My commission expires March* 30, 1915.)

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TRADE AND MISCELLANEOUS NOTES

Coming Events.

June 1-3, 1915.—Seventh annual convention of the National District Heating Association in Chicago, Ill. Headquarters at the Hotel Sherman. Secretary, D. L. Gaskill, Greenville, O.

June 21-24, 1915.—Twenty-seventh annual convention of the National Association of Master Steam and Hot Water Fitters, in Milwaukee, Wis. Headquarters at the Hotel Wisconsin. Secretary, H. B. Gombers, 260 West Broadway, New York.

June 30 and July 1, 1915.—Annual convention of the National Association of Master Plumbers at Chicago, Ill.

Deaths.

William K. Pierce, formerly president of the Pierce, Butler & Pierce Mfg. Co., of Syracuse, N. Y., shot himself April 5 at the home of a friend, Major Charles P. Lynch, in Washington, D. C. Mr. Pierce had suffered from a nervous breakdown, following the failure of the Pierce, Butler & Pierce Mfg. Co., in 1913. He was a grandson of the founder of the Pierce, Butler & Pierce Mfg. Co., and was one of the organizers of the American Boiler Company, composed of several of the largest boiler manufacturing concerns in the country, which was later dissolved. Mr. Pierce was about 65 years old. He is survived by a widow, one daughter and two sons.

Charles A. Stephens, formerly a member of the firm of Story & Stephens, manufacturers' representatives, of New York, died April 13. He had been in declining health for some time. Mr. Stephens was for many years active in the wrought pipe industry. About four years ago he formed a partnership with Robert K. Story, with offices at 150 Nassau Street, New York.

James C. Hutchinson, vice-president of the Standard Regulator Co., New York, and well known in the heating trade, died suddenly April 15, of heart disease. Mr. Hutchinson was 54 years old and had been associated with the Standard Regulator Company since its organization. Previously he had been connected with the Johnson Service Company. He was a prominent factor in the development of the temperature regulation business. Mr. Hutchinson was born in Boston and was a graduate of Boston College. A widow and one daughter survive him.

John D. Walsh, superintendent of the American District Steam Co., North Tonawanda, N. Y., and holder of numerous mechanical patents on underground heating systems, died April 13 at his home in Lockport. He was 74 years old. Mr. Walsh learned the pattern-making trade with the late Birdsill Holly, inventor of the first underground heating system and founder of the American District Steam Company. He was the superintendent of the company's first plant. He was the sole surviving member of the original organization.

Central Station Heating Notes.

Spokane, Wash.—Following the approval by the city council of the plans and specifications of the downtown central heating system of the Trustee Company, work has been begun on the system by the American

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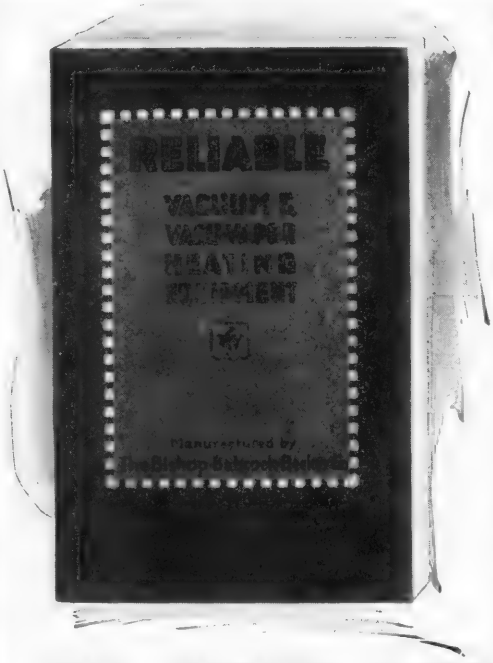
District Steam Company which has the contract for the installation. The heating mains will extend from about 50 ft. west of Washington Street westward in the alley between Riverside and Main Avenues to Post Street, south in Post Street to Riverside Avenue and west in Riverside Avenue to about midway between Lincoln and Monroe Streets. The plant will involve an expenditure of about $500,000. It is the intention to have the system in operation next fall. A. W. Peters is the constructing engineer in charge. It is expected that the power plant will be either in the Eagle Building or the Temple Court Building.

Des Moines, Ia.—The offer of the Des Moines Electric Company to build a central station heating system in Des Moines is again before the city council in the shape of a proposed franchise granting to that company the right to construct and maintain a system for furnishing heat. The company, it is stated, desires to have the ordinance approved by the city council so that it can be accepted by June 1, and construction work begun in time to have the system ready at the beginning of the next heating season. It will require a special election to adopt the proposed franchise. The service of the system as proposed by the Des Moines Electric Company would be given in the district bounded by West Second Street, Court Avenue, Tenth Street and Chestnut Street. Last June the company presented a tentative franchise to the Chamber of Commerce, which failed to secure from that body a recommendation because of what were considered exorbitant rates. The rates proposed in the new franchise are as follows: 80 cents per 1,000 for the first 20,000 lbs. or less of steam consumed in any month (the previous rate proposed was $1.00), 70 cents per 1,000 for the next 20,000 (the previous rate was 90 cents), 60 cents per 1,000 for the next 60,000 lbs. or less, 50 cents for all over 100,000 lbs. or less. The proposed franchise includes a provision for fixing rates at the end of the first three years of operation. In the franchise draft as submitted by the Continental Gas & Electric Company which for a time maintained headquarters in this city for the purpose of securing a heating plant franchise, the following rates were submitted: 75 cents for the first 50,000 lbs. of steam or less of any month, 70 cents for the next 20,000 lbs., 60 cents for the next 20,000 lbs., 60 cents for the next 20,000 lbs.

"Engineers we have had in Des Moines studying the local situation have decided that the average consumption per month by the buildings in the area in which the plant would furnish service would be about



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150,000 lbs.," said a representative of the Des Moines Electric Company recently. "Under the franchise as submitted by us the average charge per building would thus be $86.45, as against $100.50 under the Continental rates.

"Of course, there is no attempt made to attack the rates offered by the other company, as such would be useless now that it has retired from the local field, but as erstwhile competition they furnish a good basis for comparison. The average charge per 1,000 lbs. of steam would amount to 57.6 cents under this rate, while under the other to 67 cents."

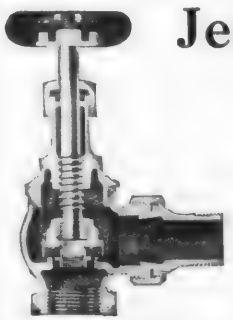
Iowa City, Ia.—As a result of a meeting which was held in Iowa City between the present members of the city council, the members of the previous council, a committee on municipal lighting, members of the Commercial Club and John A. Reed, of Cedar Rapids, it is expected that the plans of Mr. Reed and his committee, which provided for the construction of a new plant for heating and lighting the city, will be carried out. A company, to be capitalized at $200,000, is being formed for the purpose, and a number of southern Iowa people are interested in the project. It is expected that articles of incorporation will be filed shortly.

New Ulm, Minn.—Plans are being discussed for a municipal heating plant at New Ulm. It is estimated that one mile of mains will be included in the system which, it is estimated, will cost $30,000. It is proposed to heat four business blocks with exhaust steam from a central plant.

Indianapolis Light & Heat Co., Indianapolis, Ind., was the host at an inspection trip and luncheon tendered the members of the Rotary Club, of Indianapolis recently. This is an organization designed to promote better acquaintanceship on the part of the members with the resources and advantages of their own city. More than 300 men were included in the party.

Tacoma, Wash.—The heating franchise granted the Tacoma Steam Heating Company by the city council last April has been held valid by Superior Judge Easterday who at the same time handed down a decision declaring the referendum petitions filed by the stationary engineers of the city to be insufficient and not prepared as prescribed by law. This will permit the heating company to begin work immediately. The franchise provides that the city may take over the plant at any time and that a gross earnings tax shall be paid the city annually. The original plans provide for the laying of steam heating pipes in the residence district between North C and J Streets and North 2d and 6th Streets. It was also proposed to construct the plant on Dock Street, near the foot of South 12th Street, to supply heat to the business district.

Indianapolis, Ind.—The new street lighting system constructed by the Merchants' Heat & Light Company under its contract with the city was formally placed in ser-



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vice April 1. The new system includes 2,380 arc lights.

Miscellaneous Notes.

Ohio Electric Industrial Heating Association is the title proposed for an organization of electric current and light salesmen. A further meeting is planned to be held in Columbus in May. The universal use of electric heat is the purpose of the association.

Los Angeles, Cal.—A notice received of the programme of the Exhibitors' Association of Los Angeles shows the president of the association to be Thomas Fellows, who is well known among heating engineers, being the inventor of a system for keeping houses cool by means of water sprays on the outside walls.

University of Wisconsin, Madison, Wis., announces the fifteenth annual summer session of the College of Engineering, to be held at Madison during the six weeks beginning June 21. Special courses will be given in electrical, steam and hydraulic engineering, mechanical drawing, etc. Additional details may be obtained from F. E. Turneaure, Dean, Madison, Wis.

President A. W. Williamson and Vice-

American Standard Automatic Air Pump

Having a Special NO-DOWN-DRAFT feature, it insures a steady upward pull at all times.

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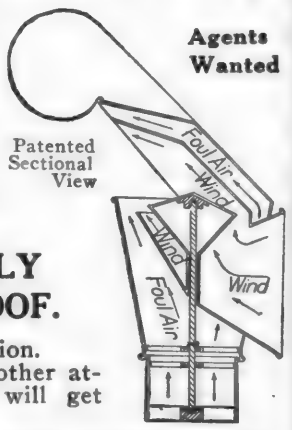

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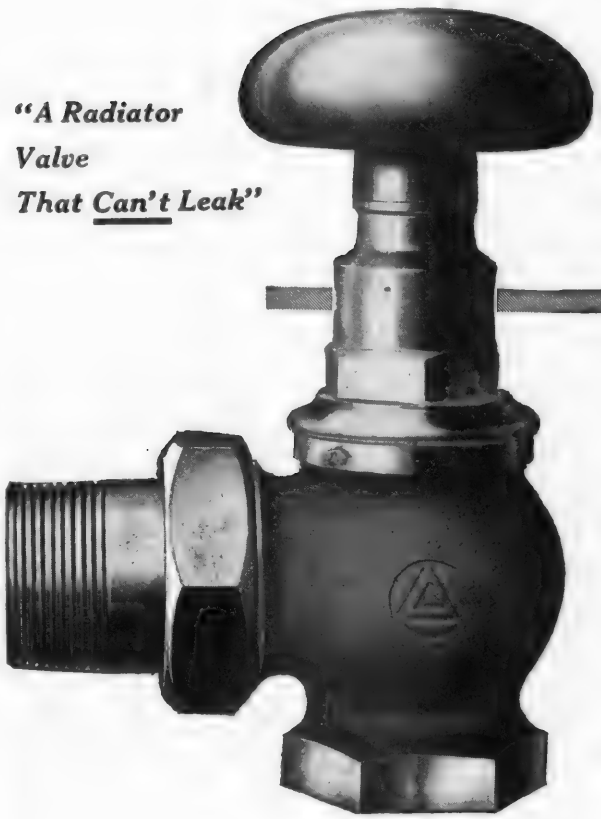

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President A. J. DeCamp, of the Williamson Heater Co., Cincinnati, O., were the guests of honor at a dinner given by the Cincinnati Business Men's Club April 1, in celebration of the twenty-fifth anniversary of their connection with the company.

Des Moines, Ia.—Sentence was passed March 31 on four of the 36 master plumbers who were found guilty in the Federal Court of violating the Sherman anti-trust law. By agreement between the attorneys for the government and for the master plumbers, the sentences were passed on two men from each list of defendants so that an appeal could be taken to the United States Circuit Court of Appeals as test cases. The government selected Robert Knauer of Des Moines and H. B. McCarten of Dubuque as the two defendants against whom it has the strongest case. These men had each received a fine of $1,000. The men selected by the defendants were George H. Wentz of Lincoln, Neb., and George H. Cunningham, of Kansas City, Mo. These men had each been fined $500. In pronouncing sentence Judge Pollock stated that in his opinion the defendants had not been guilty of criminal intent.

Boston, Mass.—Governor Walsh, in a special message to the legislature, recommends the establishment of a new state department to have charge of the inspection of boilers and the examining and licensing of engineers and firemen. These matters are now in the hands of the Massachusetts District Police.

Seattle, Wash.—Prospective contracts for heating and ventilating contracts in Seattle include the Commercial School at Everett, the Monroe School at the same place, the new theatre building of the Osran Amusement Company at Bremerton and the Washington Natatorium at Seattle. The Adams Engineering Company, of Seattle, are preparing the plans in each case.

Cleveland, O.—Ventilation in street cars and schoolhouses is not up to the health division standards, according to reports submitted to Commissioner of Health Ford by City Chemist White. Tests showed the air to be heavily laden with carbon dioxide. Three East Side and an equal number of West Side car lines were chosen by Mr. White for his tests. As for the schools, air tests at the Normal School on Stearns Road showed 10.33 parts of carbon dioxide in 10,000 parts of air. The figures were in some cases over 20 parts in street cars. The city ordinances provide that in existing buildings the carbon dioxide shall not be permitted to rise above 12 parts in 10,000. Acting on the report, Commissioner Ford

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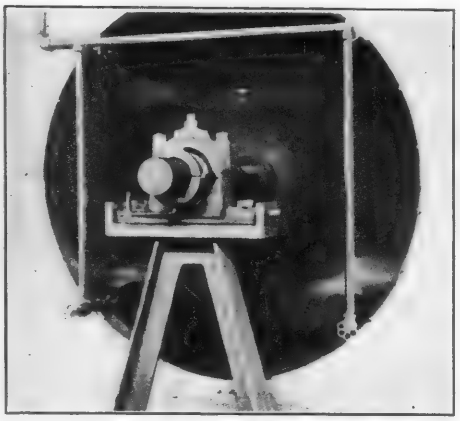
for the air washer when you install a



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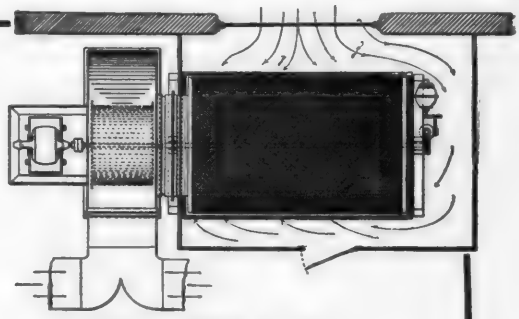

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has recommended to Director of Schools Hogen that ventilation in institutions of learning may be improved. He defended, however, the Cleveland Railway Company against charges of poor ventilation and expressed the belief that the cars are overheated, rather than poorly ventilated. He referred to the highest amount of carbon dioxide, 23 parts, found in a Superior Avenue car containing 110 passengers, and stated that he did not see how better ventilation could be provided with that many passengers aboard, unless the entire roof were removed.

New York.—By a vote of three to two the New York Public Service Commission voted to call in a firm of outside experts to determine whether an improved method of ventilation can be devised to take the place of the sidewalk gratings system planned and partly carried out in the new Broadway subway. The action was taken over the objection of the chairman of the commission and Chief Engineer Alfred Craven. The commission voted to call in the firm of J. G. White & Co. As already noted, the use of sidewalk gratings has been the cause of numerous objections on the part of property owners, heating engineers and others, on the ground that they would blow the subway dust and dirt in the faces of the passersby, as the gratings were to serve as air outlets from the subway.

Wichita, Kan.—The steam-heating equipment of an Interurban passenger car exploded March 30 as the car was entering the city from the north. The motorman and two of the passengers were slightly injured by flying glass.

Lincoln, Neb.—The problem of heating the new buildings to be built on the university campus is now confronting the university authorities as the present plant is barely able to care for the present buildings on the campus.

Dayton, O.—The proposed installation of a furnace heating system in the new Dayton View School, a contract for which was to have been awarded to the Lamneck Co., of Columbus, has brought out some interesting data as to the relative merits of hot air and steam for heating purposes. It was stated, for instance, that the proposed furnace heating plant will cost $6,000 less and that it will take less room. It was pointed out that the McKinley School, in southeast Dayton, having 19 rooms, has a steam heating plant. The cost of heating this building for two years was $668.76. The Longfellow School, of 20 rooms, also

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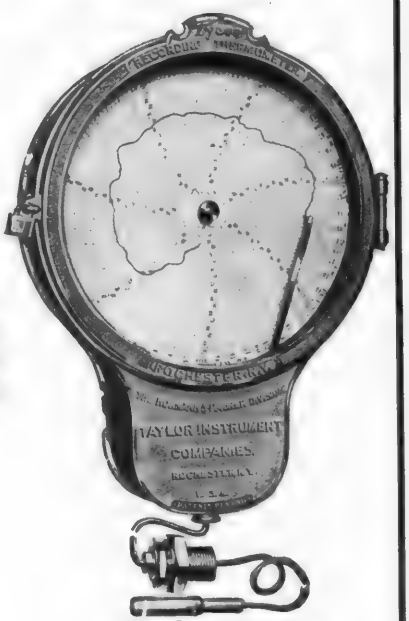

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have other desirable mechanical features. Both the strainer and the eliminators are right. We cannot tell all the details here, but expert Heating and Ventilating Engineers have recommended it for such buildings as the New Bureau of Engraving and Printing, Washington; Geology Building, University of Chicago; Allegheny Carnegie Library, Pittsburgh; Erie Theatre, Chicago; New Kansas City Union Railroad Terminal.

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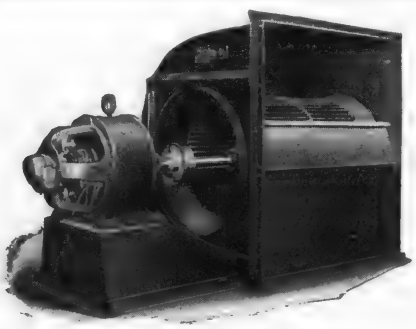
with a steam plant, during the same two years cost $538.62. On the other hand, the Washington School in East Dayton, with 21 rooms, has a hot air furnace system, and was heated during the same period for $496.40. It was claimed that this saving is largely due to the fact that a hot air furnace system can be operated by two janitors at $105 per month, while a steam plant requires the services of a licensed engineer at $78 per month, in addition to a janitor at approximately $65 per month. Bert L. Baldwin, of Cincinnati, who was called in to advise the board of education regarding the proposition, presented a report in which he criticised the plans and specifications for the hot air system as being too loosely drawn up and expressed his opinion that the cost of a steam heating system could be brought down to within a few hundred dollars of the hot air system.

Chicago, Ill.—Heating Contractors' Club of Chicago is the name of a new organization of independent heating contractors whose object is to make an agreement with the steam fitters' union on a wage scale. A determined effort is being made by Chicago contractors to institute a new form of working agreement which will prevent spasmodic tieups in building construction caused by jurisdictional disputes between unions, or strikes called to compel higher wages. A dozen unions in the building trades have accepted the agreement. The contractors, it is said, are agreed that every union that refuses to accept the agreement, which provides that all disputes between the contractors and the workmen be settled by arbitration, shall be driven from the building construction field. One of the first matters placed before the new mayor, William Hale Thompson, was an appeal to use his influence to prevent the threatened strike of carpenters who had demanded an increase in pay from 65 to 70 cents an hour. The contractors had offered an increase of 2½ cents an hour, to go into effect, however, only during the last eighteen months of the new three-year agreement.

Pittsburgh, Pa.—A receiver's sale of all the assets of the Hydraulic Vacuum Cleaning Co., of Pittsburgh, was held at the offices of the company, in the Jenkins Arcade Building, April 28. The sale was conducted by H. C. Snyder, receiver.

Eastern Trade Golf Association, at its recent annual meeting, at Murray's, New York, elected the following officers: President, A. S. Armagnac; vice-president, G.



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Interior of second floor of main shed—Boston Commonwealth Pier No. 5—Note how large distributing duct in center of building divides into two branches and supplies warm air ducts in both bays. Consulting Engineers and Designers, Sanitary Engineering Company, Boston, Mass.

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M. Scott; secretary-treasurer, Raymond G. Bookhout; captain, J. Barton Garfield. Board of governors: Joseph Simmons, H. R. Watson, W. H. Burnett; W. W. Hubbard and Farnham Yardley.

Manufacturers' Notes.

XXth Century Heating & Ventilating Co., Akron, O., has announced the inauguration of a profit-sharing policy for the benefit of its employes. More than 175 employes will be affected by the new policy which will go into effect July 1. As outlined by President and General Manager John Kerch, the plan will be a bonus system of profit-sharing. At the same time it is the intention of the company to pay top-notch wages. It is estimated that the bonuses will amount to several thousand dollars a year. Regarding business prospects, Mr. Kerch expressed the opinion that "the bad effects of the European war are passing rapidly in America. When the war is over, or even before that time, there will be an extraordinary business boom, with a shortage of labor. Those concerns paying proper wages will prosper; those unwilling to adjust themselves to the new conditions will suffer."

Vapor Heating Co., Philadelphia, Pa., announces the removal of its New York office to the Scribner Building, 597 Fifth Avenue. Charles E. Scott is the company's New York manager.

Minneapolis Heat Regulator Co., Minneapolis, Minn., is planning an addition to its plant that will practically double its capacity. The floor space will be enlarged 16,000 sq. ft. William R. Sweatt is the president of the company, which has shown a notable growth under his direction.

American Thermostat Co., Elmira, N. Y., has moved its factory and general offices to Newark, N. J., at 101-103 Mechanic Street.

General Filtration Co., Inc., has moved its sales offices from Pittsburgh, Pa., to the general offices of the company in the Cutler Building, Rochester, N. Y.

American District Steam Co., North Tonawanda, N. Y., has opened an office in New York, at 90 West Street, under the management of G. C. St. John, formerly president of the New York Steam Company.

Warren Webster & Co., Camden, N. J., announce the resignation of John F. Hale as general manager of the company. The announcement states that "Mr. Hale's action is entirely voluntary and he leaves, with our best wishes for his future suc-

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Ventilating Fans

possess the following special features:

High Efficiency—Note the special construction of the fan. This design, together with the high electrical efficiency of the motor, insures the movement of the maximum amount of air for a given amount of power consumed.

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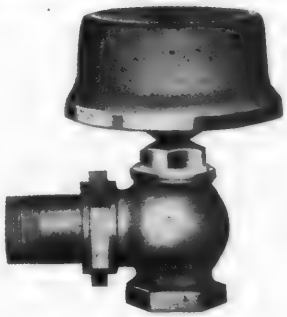

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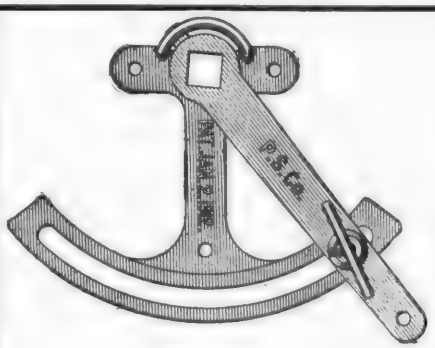

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cess, to take charge of another company." Mr. Hale has associated himself with the Consolidated Engineering Company, of Chicago, where he will be permanently located.

Pullman Automatic Ventilator Mfg. Co., York, Pa., is about to place on the market a small ready-to-run exhaust ventilator, which the company has developed after considerable experimenting. The new device has a number of interesting features, being the smallest practical electric-driven exhaust unit in the market. It will be supplied in a portable panel, ready to install over or beneath a window, or the motor, frame and fan may be bought separately and installed directly in an opening in the wall. The new device has been named the Pullman whirlwind exhaust ventilator.

Spray Engineering Co., Boston, Mass., engineers and manufacturers of air washers, etc., announces the election of Lee H. Parker as president. Mr. Parker has had a wide experience in the engineering field, having been for a number of years with the General Electric Company, and for the past ten years with the Stone & Webster Engineering Corporation.

Bristol Co., Waterbury, Conn., manufacturers of Bristol recording instruments, announces the removal of its Pittsburgh branch from 1670 Frick Annex to better quarters at 832 Frick Building. The company's Pittsburgh district manager is R. B. Anthony.

Century Ventilating Co., manufacturer of the Automatic suction ventilators, has removed its plant from Brooklyn to 424-426 East 23rd Street, where it has improved facilities for manufacturing its product as well as making deliveries.

Kanawha Mfg. Co., Charleston, W. Va., is the new name of the Kanawha Mine Car Co., manufacturer of the well-known Bernhard heating boilers. The company has increased its capitalization to provide for a larger output of this boiler.

Pullman Automatic Ventilator Mfg. Co., Inc., York, Pa., reports a recent shipment of forty Pullman roof ventilators to a contractor in Kokomo City, Ind., for use on a public school building in that city. The ventilators ranged in size from 12 in. up to 54 in. and were made of galvanized steel.

Lavigne Mfg. Co., Detroit, Mich., elected the following officers at its recent annual meeting: President, P. D. Dwight; vice-president and general manager, N. A. Henwood; secretary-treasurer, C. L. Brumme.

Designing Heating and Ventilating Systems

THIS book treats on the practical application of the best engineering rules and formulas in every-day use. It tells how to lay out a Steam, Hot Water, Furnace and Ventilating Equipment for any kind of a building. It gets right down to practical heating in the very first chapter, illustrates and describes the detailed use of exactly the same methods that the most proficient engineers use. It tells how to determine the sizes and proportions of equipment for every-day work. It helps you to solve difficult heating and ventilating problems that may confront you for the first time.

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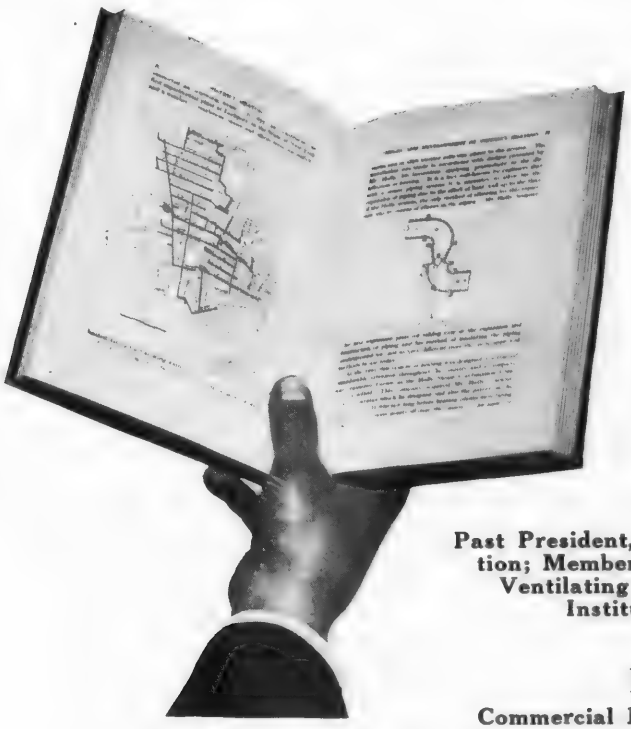

A Full and Practical Treatise on Central Station Heating

District Heating

by

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and

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Commercial Engineer, Illinois Maintenance Co.

This book not only imparts a general knowledge of District Heating to those who wish to study the subject, but is also designed to promote the interests of District Heating companies. For this purpose various points on economical operation are suggested, as illustrated in the methods practiced by companies which have made a success in this line of work. Comparative data are also presented indicating the prices that can reasonably be charged for heating service.

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CHAPTER I—Origin and Development of District Heating
CHAPTER II—Selling of Heat
CHAPTER III—Heat Distribution Systems
CHAPTER IV—Metering
CHAPTER V—District Heating Stations
CHAPTER VI—Methods of Estimating Heating Requirements in Buildings
CHAPTER VII—Estimating Miscellaneous Steam Requirements in Buildings
CHAPTER VIII—Relation between Heat Load and Electric Load in Buildings
CHAPTER IX—The Use of Heating Data in Connection with Estimating on the Cost of Isolated Plant and Central Station Service
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"District Heating" contains all the important data regarding the development of central station heating and is an invaluable handbook, not only for central station engineers, but also for those contemplating taking up this business which is rapidly becoming one of the largest and most important in the country.

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Mr. Dwight succeeds J. P. Lavigne as president. Mr. Lavigne will continue to act as consulting engineer for the company.

Joseph Dixon Crucible Co., Jersey City, N. J., elected the following directors at its annual meeting, April 19, at which the vote recorded was the largest ever represented at an annual election of the company, 19,519 shares out of 20,000: George T. Smith (president), Robert E. Jennings, George E. Long (vice-president), E. L. Young, William G. Bumsted, J. H. Schermerhorn (treasurer) and Harry Daily (secretary). Albert Norris was elected assistant secretary and assistant treasurer.

American District Steam Co., North Tonawanda, N. Y., has sold its old manufacturing plant to the Harrison Mfg. Co., Lockport, N. Y., manufacturers of automobile radiators. The radiator company has occupied the buildings for some time.

New Firms and Business Changes.

Cleveland Heating Co., Cleveland, O., has reduced its capital stock from $350,000 to $35,000.

Hoffman Heater Co., Lorain, O., has increased its capital stock from $75,000 to $100,000.

Prichett & Cushman, Fort Madison, Ia., is a new firm of heating and plumbing contractors composed of John L. Prichett and E. T. Cushman.

Chapman Plumbing & Supply Co., Canton, O., has increased its capital stock from $10,000 to $100,000.

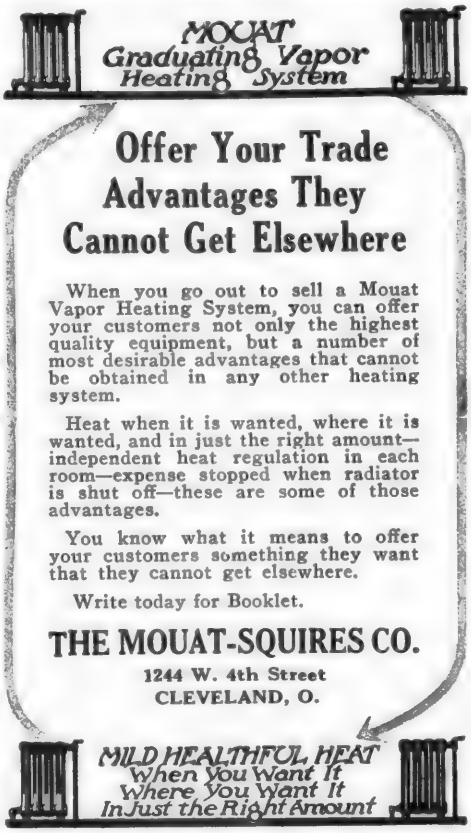
Fakler Plumbing and Heating Co., Rochester, Minn., is the new name of the F. F. Yost Plumbing & Heating Co., the business having been purchased by John Fakler, formerly with C. M. Masters, of Mankato.

Richard Murphy Plumbing Co., Cincinnati, O., has increased its capital stock from $15,000 to $25,000.

Herrin, Ill.—The Egyptian Plumbing & Heating Co., of Herrin, has purchased the bankrupt stock of the Carbondale Plumbing & Heating Co., of Carbondale, Ill.

E. B. Sumpter Plumbing & Heating Co., Bowling Green, Ky., recently incorporated, has elected the following officers: President, E. B. Sumpter; vice-president, James D. Sumpter; secretary-treasurer, F. E. Curd.

J. J. Rudd & Sons, Aurora, Ill., is the new title of the heating and plumbing business conducted by J. J. Ruddy. The new mem-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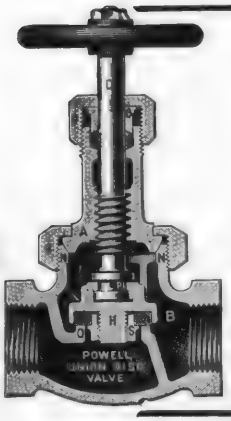

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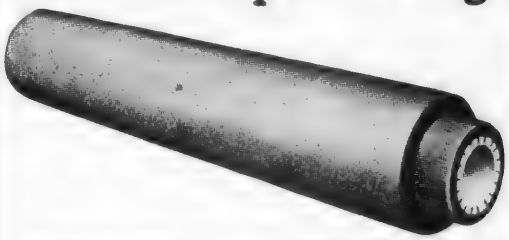

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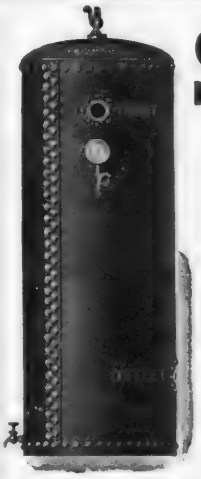

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bers of the firm are Frank Ruddy and Walter Ruddy.

J. Byers Holbrook, New York, consulting engineer, announces the removal of his engineering offices to the Vanderbilt Concourse Building, 25 Vanderbilt Avenue, New York.

Griggs & Myers, consulting engineers, is the title of a new firm composed of John S. Griggs, Jr., electrical and mechanical engineer, and David Moffat Myers, mechanical engineer with offices at 110 West 40th Street, New York. Mr. Griggs was for twelve years senior partner of the consulting engineering firm of Griggs & Holbrook, of New York. Mr. Myers was formerly mechanical engineer for the United States Leather Co., in charge of the efficiency work in this company's steam plants. In 1906 he started his private consulting practice. He is the author of "Preventing Losses in Factory Power Plants."

East Moline Plumbing & Heating Co., East Moline, Ill., has moved to new quarters at 821 Fifteenth Avenue.

New Incorporations.

Central Plumbing Co., Indianapolis, Ind., capital $13,000, to conduct a heating and plumbing business. Incorporators: Charles A. Johnson, Maurice L. Wolfanger and Martin C. Specht.

Michigan Warming & Ventilating Co., Saginaw, Mich., capital $10,000 to manufacture heating and ventilating specialties.

Ideal Plumbing Co., Carbondale, Ill. capital $4,000, to conduct a heating and plumbing business. Incorporators: C. C. Stollar, John N. Stollar and Frank B. Grady.

Noland-Clifford Co., Newport News, Va., capital $10,000, to conduct a heating and plumbing business. President, L. U. Noland; vice-president, T. B. Clifford; secretary, Frank Roth, all of Newport News. Mr. Nolan was formerly connected with the Newport News Contracting & Engineering Co.

J. D. Swarthout Co., Saginaw, Mich., incorporated to manufacture heating specialties. Incorporators: J. D. Swarthout, E. C. Graham and E. M. Swarthout.

Graves Supply Co., Cincinnati, O., capital $30,000, to deal in heating specialties. Incorporators: George W. Graves, William L. Nersfelder, Clifford W. Varwig and Walter A. Todd.

C. A. Huffman Co., Newport News, Va., capital $5,000, to engage in heating and plumbing work. President, C. A. Huffman; secretary and treasurer, W. E. Cottrell, Jr.

Bockway Plumbing & Supply Co., Huntington, W. Va., capital $5,000.

Wayne Plumbing, Heating & Supply Co., Newark, N. Y., capital $2,000. Incorporators: Jesse T. Spaulding, Cornelius J. Engels, E. D. Spaulding and E. Engels.

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Meyers Mfg. Co., New York, capital $50,000, to manufacture heaters. Incorporators: C. D. Meyers, G. H. Davis and G. Heagy.

Robblin-Demerath Co., Rochester, N. Y., capital $10,000, to construct and install heating systems, etc. Directors: C. F. Demerath, Joseph Demerath and Richard G. Robblin.

Frost Co., Buffalo, N. Y., capital $10,000, to conduct a business as heating and ventilating engineers and contractors. Incorporators: Gordon T. Hackett, Albert T. Spaulding and Robinson V. Frost.

Harrison Plumbing, Tinning & Heating Co., Little Rock, Ark., capital $10,000. Incorporators: C. V. Caster, J. O. Wilson and Day Clark.

Scheibs-Munro Hardware Co., Evanston, Ill., capital $2,500, to conduct a heating, contracting and hardware business.

Merchants Contracting Co., Indianapolis, Ind., capital $1,000, to manufacture electricity and heat in isolated plants for private consumers. Directors: H. H. Harrison, B. T. Gifford and C. McPherson.

Phelps Heating Specialty Co., New York, capital $50,000, to manufacture machinery, etc., connected with electric or other power plants. Incorporators: R. A. Koontz, H. J. Neuschafer and C. S. Ashley, 295 Broadway, New York.

Tobias Heater Co., Homestead, Pa., capital $20,000. Incorporators: J. M. Tobias, James Ward, Jr., H. P. Wiggins, Pittsburgh; George H. Wilson, J. Clyde Miller, M. W. Coulter, Homestead, and William Menk Munhall.

Jeffersonville Plumbing Co., Indianapolis, Ind., capital $1,000, to engage in steam and hot water fitting and plumbing. Directors: William C. and Theodore B. Brydon and Bruno W. Habermann.

Albert B. Franklin, Inc., Boston, Mass., capital, $25,000, has been incorporated to take over the heating and ventilating business formerly conducted by the late Albert B. Franklin. President, Ralph S. Franklin; treasurer, Laurence Franklin. G. B. Stetson is also a member of the corporation.

Business Troubles.

Osborne, Rea & Co., New York, heating and ventilating contractors, has been placed in bankruptcy on petition of the following

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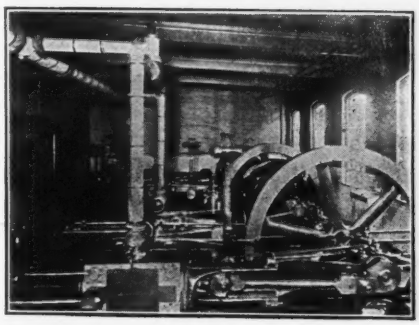

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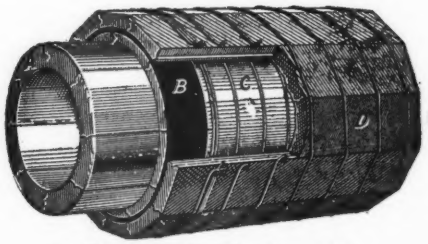

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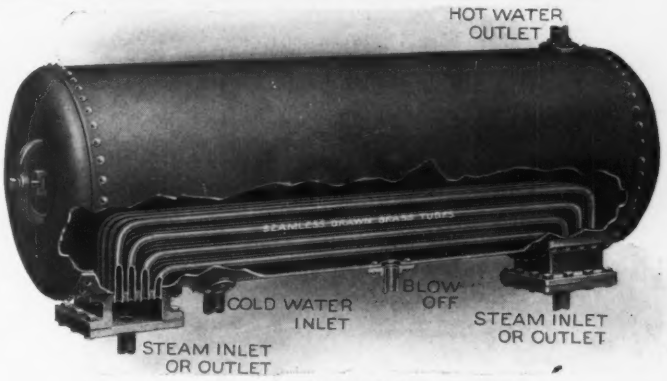

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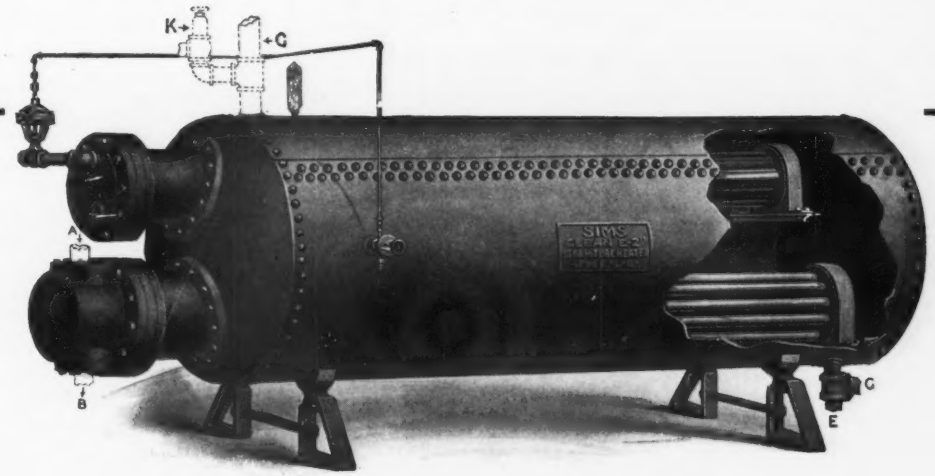


WHEN THE HOT WATER DEMAND RUNS HIGH

Our large experience in manufacturing heaters for laundries has developed the fact that there is not always enough exhaust steam to heat all the water to the temperature required. This is always the case with a wet-wash laundry. For a high hot water demand use the

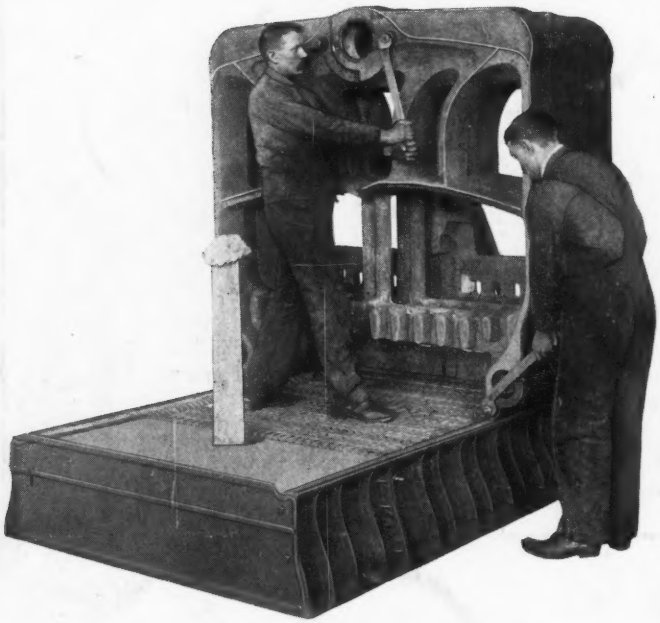
SIMS CLEAN E-Z HEATER, TYPE D.

This heater is supplied with two sets of straight, seamless drawn brass tubes, the lower for exhaust steam, located in the coolest water. The upper set of tubes is for live steam direct from the boiler, controlled by a thermostat.

Our Bulletin HL-2 gives full particulars of Sims Heaters for laundries, hotels, hospitals and other service. Consultation free. All work guaranteed.

THE SIMS COMPANY **18th Street, Erie, Pa.**

Save the interest on your money



Erecting a large Sectional IDEAL SMOKELESS Down-Draft Boiler

A steamfitter's work must necessarily follow after the work of the other contractors on the job. Why buy a one-piece boiler that must lie idle, sometimes for months, while the house is being slowly built over it.

An IDEAL Boiler need not be purchased and delivered to the job until the contractor is ready to set it up. Then when the other workmen are out of the way an IDEAL Boiler may be brought into the basement section by section and easily put in place upon a basement floor that has had time to set and harden.

From this feature alone the continued use of IDEAL Boilers may be made to show a snug item of saving in a contractor's yearly statement.

AMERICAN RADIATOR COMPANY

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